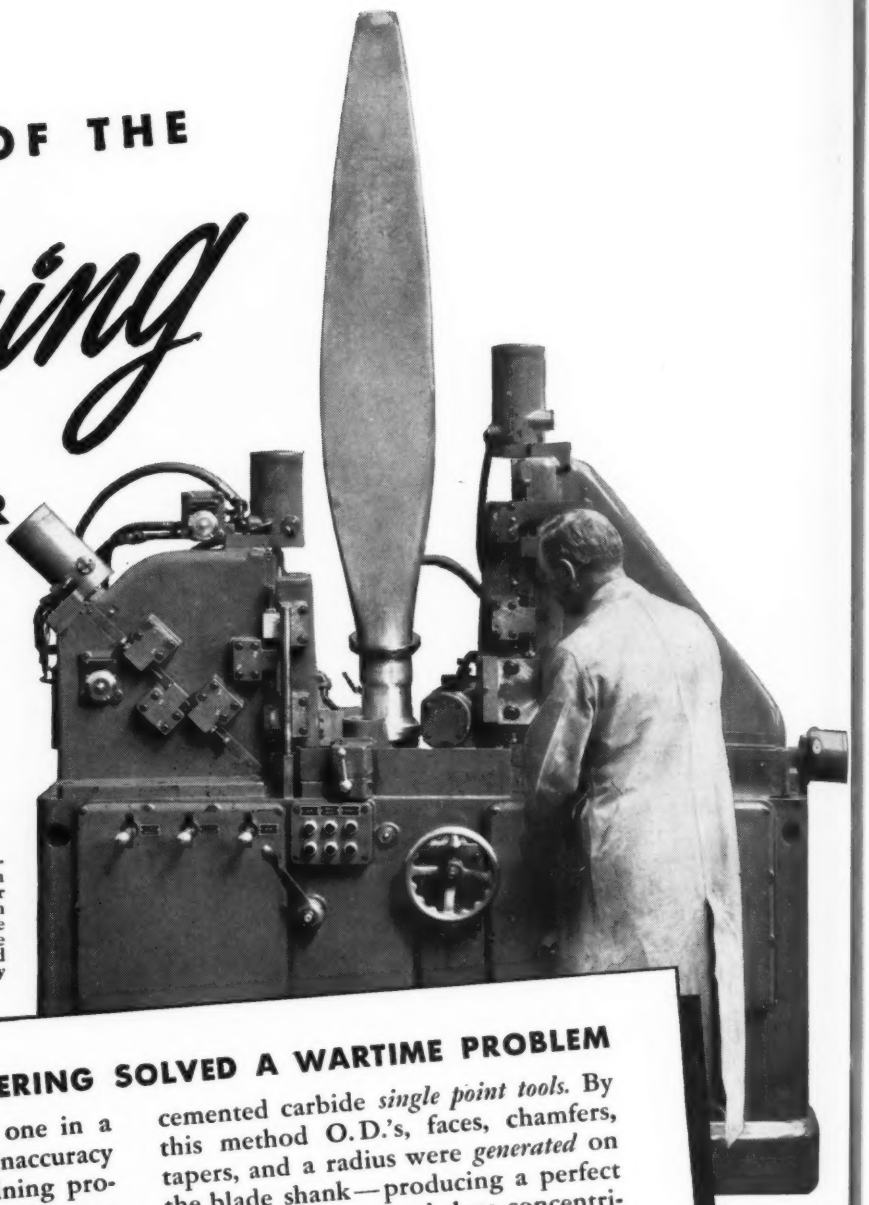
JANUARY 1944—FIFTIETH YEAR

MACHINERY

THE CASE OF THE *Sagging* PROPELLER



This special Heald Bore-Matic completely solved the customers problem of finishing the shank end of propeller blades—producing precision to such degree that hand operations have been reduced from four hours to five minutes per blade. The blade is rotated vertically and surfaces are finished by hydraulic tool slides.

HOW HEALD ENGINEERING SOLVED A WARTIME PROBLEM

Sag was bugbear number one in a propeller plant...sag caused inaccuracy and eccentricity when machining propeller blade shanks . . . simply because blades were chucked horizontally. Bugbear number two was form tools . . . maintaining their edges for plunge cutting the blade shank was difficult and unsatisfactory. Inevitably, excessive hand operations were required, and production was slow and costly . . . so much so that a new and better method was imperative.

HEALD ENGINEERING provided the solution—a special Heald Bore-Matic. This machine eliminated troublesome sag by rotating the propeller blade, *vertically* . . . eliminated, too, all the inaccuracies of form tools by using instead cemented carbide *single point tools.* By this method O.D.'s, faces, chamfers, tapers, and a radius were *generated* on the blade shank—producing a perfect thrust bearing seat and close concentricity with the bore. Net result was precision—of such degree that hand operations were reduced from 4 hours to 5 minutes per blade . . . plus sharply increased production that today is saving thousands of precious manhours per year.

Have you a wartime problem or do you need assistance in postwar planning? If it involves precision finishing, HEALD ENGINEERING is available, now, to help you.

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for More Precision Faster, bring your problem to Heald

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MACHINERY

JANUARY, 1944

The war has given the machine shops on the Pacific Coast an opportunity such as they never had before to demonstrate the high-grade workmanship of which they are capable. Shops that in peacetime turned out mining, oil field, agricultural, lumbering, and similar machinery are now manufacturing aircraft parts, ordnance, and marine engines to the closest specifications. February MACHINERY will describe machine shop operations in one of these plants which has established an excellent record in building mounts for the Navy's rapid-fire, 5-inch anti-aircraft guns. Other articles will deal with attachments that increase the versatility of high-production grinding machines, speeds and feeds for milling cutters, and the grinding of carbide tools.

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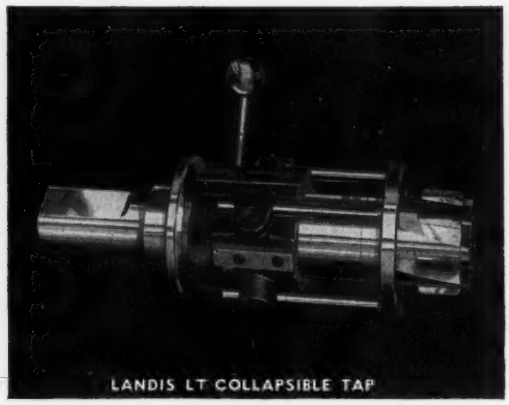

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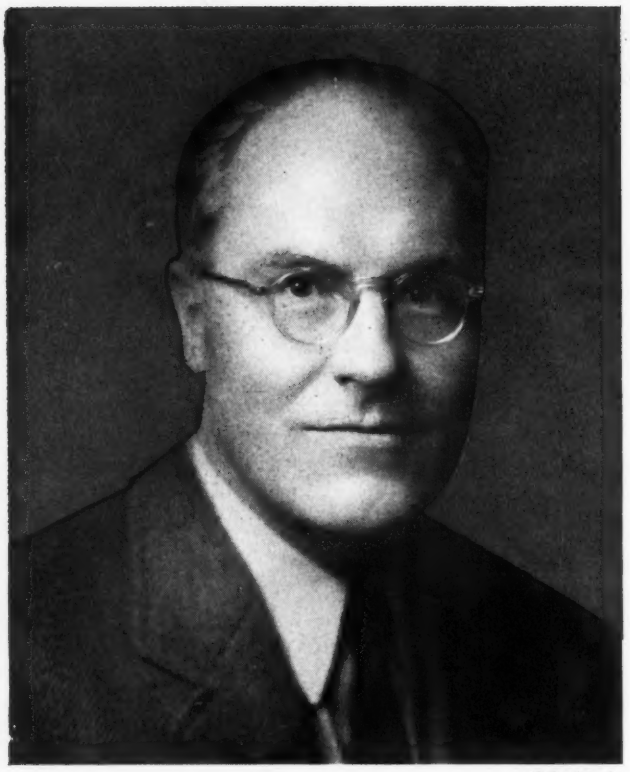
INDUSTRY
Plans for the Future
JUST as in time of peace, plans for war and measures for defense ought to be in readiness for a sudden emergency, so in time of war we must make sure that confusion and chaos do not follow the victories of the armies. . . . Plans must be prepared, and they must come into action just as, when war breaks out, general mobilization is declared. They must come into action as soon as the victory is won. . . . The policy of waging war till victory would be incomplete, and, indeed, spoiled, if it were not accompanied by a policy of food, work, and homes in the period following the victory for the men and the women who fought and won.—Winston Churchill



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By DAVID C. PRINCE
Vice-President, General Electric Co.

RECONVERSION to peacetime manufacturing is not a problem that can be left until after the war to solve. We know what it meant to convert to war production, and, if anything, it will require a greater amount of preparation to return from a 100 per cent war basis to a complete peace basis. Long before the United States entered the war, the General Electric Co. made preparations for devoting its plants and energies to war manufacture, because it had become evident that this country would have to take part in the conflict. By the same token, it is necessary to make plans for keeping production and employment at a high level when the war is over.

No matter whether a company is large or small, it cannot survive and become prosperous unless the country as a whole is prosperous. Hence, it is necessary to examine into the kind of problem that is going to face the country as a whole; and, second, to see what part one's own company may play in the solution of that problem. Briefly, that is the basis of the procedure followed by General Electric in making its post-war plans. The same procedure can be followed by any other concern, large or small.

THE first thing we tried to do at General Electric was to arrive at some idea of what the country as a whole should aim to do. To that end, we started to estimate from available facts what the country should be able to produce. It is obvious that the total output of the United States will be the sum of the production of every company and individual in the country; hence, the point of departure is what was done here in production in 1940 or 1941. Taking 1941 as the starting point, we find that the total output in goods and services was valued at $119,000,000,000. This output was divided as follows [from "Markets After the War," published by Department of Commerce]:

Gross National Production and Services in 1941	
Government Expenditures:	
Government Services, including National Defense	$7,600,000,000
Public Construction	5,900,000,000
Private Capital Expenditures:	
Private Construction	5,500,000,000
Machinery and Equipment	14,500,000,000
Miscellaneous Capital Expenditures	4,600,000,000
Consumers' Expenditures:	
Durable Goods	10,300,000,000
Services	25,200,000,000
Semi-durable Goods	11,400,000,000
Perishable Goods	34,000,000,000
Gross National Production	$119,000,000,000

The income resulting from this production of goods and services was divided as shown in the following table:

Gross National Income in 1941

Business Taxes and Reserves:	
Business Taxes	$18,300,000,000
Business Savings	8,400,000,000
Income Paid out to Individuals:	
Interest, Dividends, Rents, and Royalties	12,200,000,000
Self - employed — Farmers, Doctors, etc.	15,500,000,000
Wages and Salaries	64,600,000,000
Gross National Income	$119,000,000,000

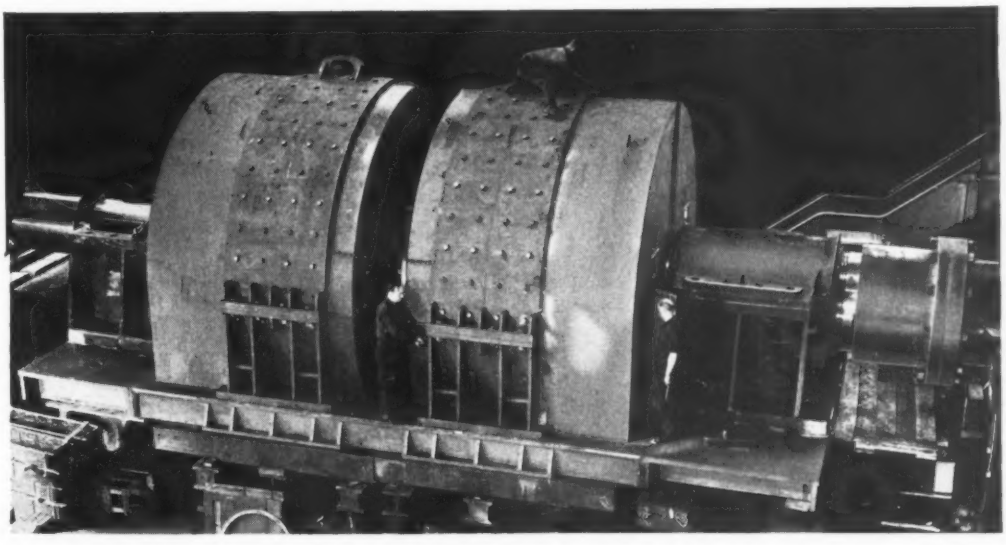
From the tabulation, we note that the largest single amount—$45,400,000,000—was spent for things that we consumed, such as food, clothing, and semi-durable goods; about $25,200,000,000 was spent for services, such as rent, medical expenses, and transportation; and $10,300,000,000 went into consumer durable goods—automobiles, furniture, electric appliances, etc.

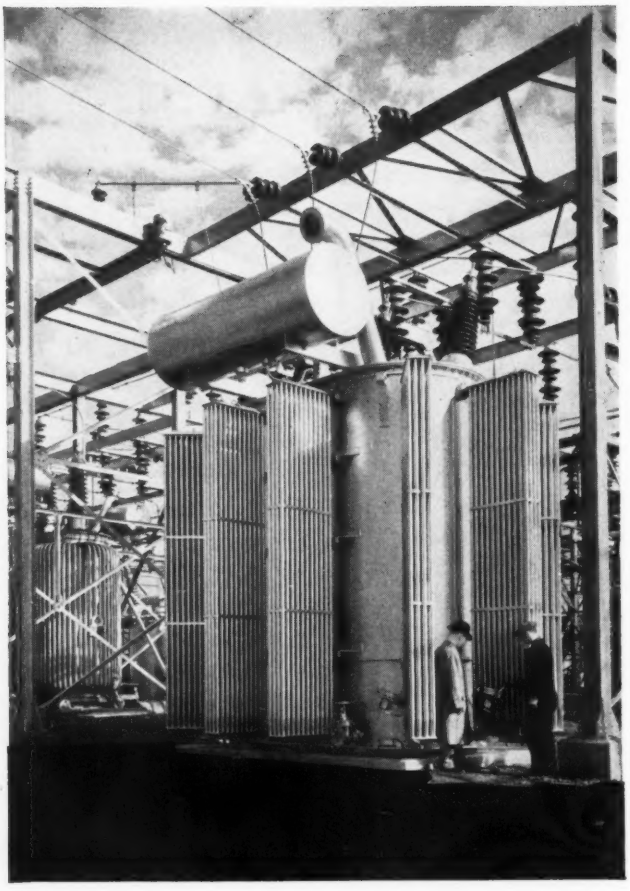
I AM often asked: "How can you tell what is going to happen after the war?" My answer is that I have not yet heard of anybody who has suggested a very great improvement over a beefsteak. I do not believe that anybody is going to invent a beefsteak that will be a great improvement over those that we have now. What I am looking forward to after the war is more beefsteaks and more people to eat them.

In other words, I do not look forward to any revolutionary changes in the kind of things that consumers will buy from industry. If you ask yourself how many of the things you do or how many of the things you use you would like to have changed to something different after the war, you would soon conclude that what you would like to do and use after the war will be similar to what you did and used before the war.

That does not mean that there are not going to be important new developments. Of course there are; but when all is said, the number of new things developed in any year is a very small fraction of all the things produced in that year, so we may be pretty sure that the pattern of a post-war year will approach fairly closely the pattern of 1941, provided we are free to spend our money as we please. From this premise, we can construct a fairly accurate picture of the national economy of a post-war year.

FIGURES have been compiled that show what would happen in this country if the normally employed part of the population





worked forty hours a week. This would mean that some 57,000,000 people would be gainfully employed, producing a total output of $149,000,000,000 in goods and services in terms of 1941 prices. The production and services may be estimated as shown in the accompanying table [The figures in this table are from "Markets After the War," and reduced to 1941 prices from tables published in "Survey of Current Business."]:

Gross National Production and Service

Government Expenditures:	
Government Services, including National Defense	$17,700,000,000
Public Construction	3,700,000,000
Private Capital Expenditures:	
Private Construction	12,600,000,000
Producers' Durable Equipment	14,000,000,000
Miscellaneous Capital Expenditures	200,000,000
Consumers' Expenditures:	
Durable Goods	14,800,000,000
Services	32,700,000,000
Semi-durable Goods	13,600,000,000
Perishable Goods	39,700,000,000
Total Expenditures	$149,000,000,000

This tabulation was based on the assumption that the country is full of plain people who will want to do in the post-war years very much the same things they did in the last year before the war and for many years prior to the war.

THE next step is to make an estimate, based on the country's total production in pre-war years of the total annual output in the post-war period of the types of finished goods in which electrical manufacturers compete. This estimate would be about as follows (same source as preceding table):

Electric Apparatus and Equipment	$940,000,000
Locomotives and Railroad Cars	440,000,000
Engines and Turbines	110,000,000
Refrigerators, Washing Machines, Sewing Machines	780,000,000
Electric Household Appliances	330,000,000
Heating and Cooking Apparatus	800,000,000
Radio Apparatus and Phonographs	650,000,000
	$4,050,000,000

Next each of the main items in the tabulation immediately preceding is broken down into separate product lines. For example, electric apparatus and equipment would be broken down into motors, controls, meters and instruments, etc. One estimate of this breakdown is as follows:

Motors	$285,000,000
Controls	70,000,000
Welding, heating and other industrial specialties	75,000,000
Transformers and related equipment	167,000,000
Meters and instruments	70,000,000
Lighting equipment	25,000,000
Wire and cable	130,000,000
Large generator and converting equipment	15,000,000
Switchgear	90,000,000
Miscellaneous equipment	13,000,000
	$940,000,000

FINALLY, it remains to determine how much of this business may be the share of your own company. If we are to be realistic, we must assume that although General Electric will work as hard as possible to increase its share of the total business, so will every other company. As a result, the realistic thing to do is to assume that your company will get approximately the same percentage of the total that it had before the war. This makes it possible to estimate accurately production for a post-war year in such a detailed way as to determine its effect on every department of the company. This can be done by every organization in the country.

We, at General Electric, have analyzed in this manner the potential market for each of the seventy-odd divisions of the company. Then, starting with this potential market, we asked the head of each division to determine how much factory space would be required for the estimated production, how much additional machinery might be needed, and how many people would have to be employed. Proceeding in this way, the required facilities can be planned, and when the analysis is completed, it is possible to determine in detail what has to be done to convert from war to peace production.

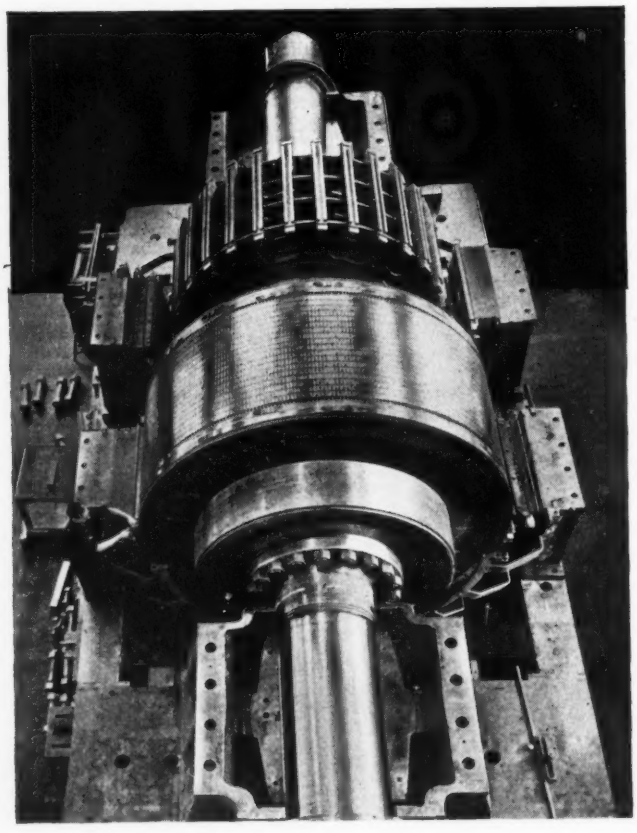
In the electrical industry, in those departments producing heavy apparatus, the post-war production will be of the same kind as the war product; the volume required will be somewhat less. Therefore, the conversion problem is mainly one of seeing what facilities and man-power can be made available for some other purpose.

THE release of facilities will not be as great as might be expected, because during the war most plants have been working as nearly as possible on a three-shift basis. It is not practicable to operate this way in normal times. On the present war basis, operations are too crowded for the highest degree of efficiency. There is inadequate opportunity for maintenance and for starting the manufacture of new designs in an orderly manner. In general, it is estimated that the necessary number of square feet per operator will be over 50 per cent greater than the present war figure, and the release of actual building space and machinery, therefore, will be smaller than the decrease in sales volume.

On the other hand, in those departments devoted to the manufacture of consumer goods, the assembly lines have been dismantled because the war product has been

essentially different from the peacetime product. The plans made, therefore, contemplate not only the dismantling of wartime production lines, but a considerable increase in factory space and the acquisition of new machinery. It is already clear that additions both to building space and machinery will be necessary if we are to meet the estimated demand for consumer goods and if we are to have manufacturing facilities in which to employ our share of workers on a normal shift basis.

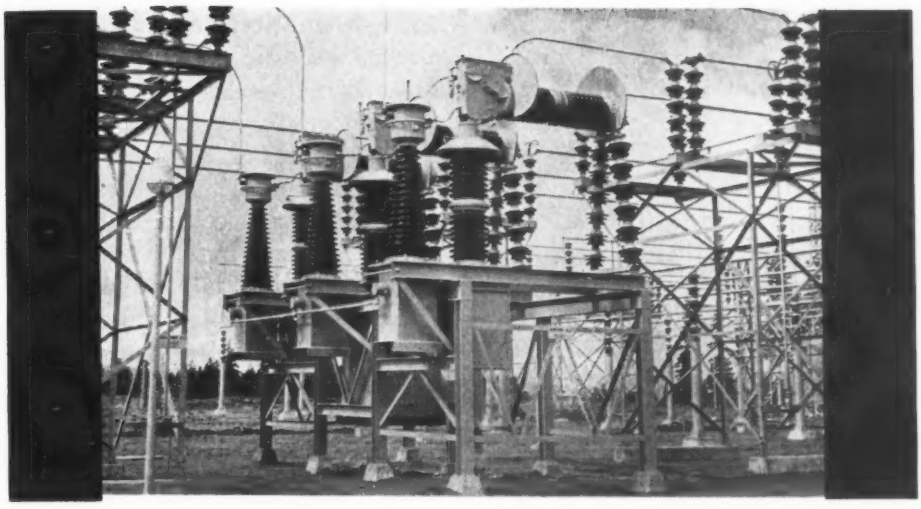
THE General Electric Co. and its subsidiaries have expanded to a point where approximately 185,000 people are employed. The surveys just referred to do not indicate that it will take 185,000 people to manufacture the company's present lines for the probable post-war demand. However, it is not likely that 185,000 employes will be available; for although 30,000 or more men have gone into the Armed Services and will be returning, there will be an even larger shrinkage in the present labor force.



At the moment, the company is employing a considerable number of elderly people who wish to retire. It is also employing a large number of young people who normally would not be employed, but who would stay in school for several years more. A great many women are now being employed; and although some of these will doubtless continue in industrial work, many others are only waiting for the end of the emergency to return to their homes. Others will return to shops manufacturing non-war products that are now temporarily inactive; and then there is quite a large number of people now engaged in manufacturing who are normally engaged in the service industries, such as garages and filling stations. These people and salesmen of all kinds that have been drawn into industry for war production will return to their normal work.

For all of these reasons, it is certain that there will not be 185,000 people available for the General Electric Co. It is likely, however, that after all post-war production requirements have been met, there will be a considerable number of people available for new production, and hence one of the objects of post-war planning is to search for new lines of activity, especially those arising out of wartime developments, which will raise peacetime living standards by employing additional people in their production.

THE methods of the General Electric Co. in carrying out its post-war planning have been referred to in detail simply because the experience of this company is typical of that through which thousands of other manufacturing plants are passing. Obviously, it is of great assistance if those in one industry endeavoring to solve long-range problems share their experiences with people in other plants confronted with similar problems. This cooperation has been encouraged by the Committee for Economic Development, of which Paul G. Hoffman, president of the Studebaker Corporation, is chairman. One of the activities of this com-



mittee has been to make a survey of a number of cities to determine what the post-war problems in employment are likely to be. To this end, local business men in several communities were asked these three questions:

1. How many people did your city employ before the war?
2. How many people are being employed now, at the height of the war effort?
3. For how many people do you anticipate jobs after the war?

IN the case of Peoria, Ill., for example, it was estimated that the number of jobs in the post-war period would be approximately the same as the number at the height of the war effort; hence Peoria does not present a serious post-war employment problem, especially if the country as a whole is normally prosperous. Springfield, Mass., however, presents a different case. Here, before the war, some 15,000 people were employed. There are 20,000 potential jobs in prospect after the war; but now, at the height of the war effort, there are 30,000 people employed in private industry, in addition to several thousands employed by the Government in the Springfield Arsenal; hence the potential unemployment in that city may be as high as 15,000. Of course, just as the figures relating to the General Electric Co. have to be discounted by many factors, so would these figures for the city of Springfield. Many of the present workers in Springfield have been drawn from the surrounding towns, and the total number who expect to be employed after the war will shrink. Nevertheless, there is the possibility of an unemployment problem here, making all the more necessary careful post-war planning.

Local business men faced with a potential surplus of labor to produce their pre-war products may find it advantageous to study the pamphlet "Markets After the War," distributed by the Committee for Economic Development and obtainable from the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C. A "Handbook for Employers" is at present also being prepared by the committee.

WE know from industry's war record that a gross national production of $149,000,000,000 in peacetime is not an impossibility. However, such an amount represents an average income of over $3000 per family, a figure that has never before been reached in peacetime in this or any other country. But the production visualized is not a production of gigantic public projects of relative little use to the average family, but a production of things that our best market information indicates the average family will want.

In this direction, therefore, apparently lies the best chance that we, as a nation, have of

winning the kind of a peace we want, interpreted in terms of what each of us wants, whether it be a house or a piece of blueberry pie. If we can keep busy the productive plants able to produce the nation's needs, we will have employment for all who are willing and able to work, and we will have a market for all the goods produced. This is what we should plan for.

IN conclusion, it should be emphasized that the best way to take care of this expansion is by the good old American way—through the initiative of individuals. The sixty-four-dollar question, then, is: "How can the initiative and the efforts of millions of individuals be coordinated so that they will be fruitful and contribute to the commonly desired end—and still leave those individuals essentially free and independent men and women?"

We have learned that in wartime the task of securing economic expansion is relatively easy, because in the midst of national danger, the individual is willing to put up with personal inconveniences and submit to orders from the Government. In time of peace, however, no American — business man, labor leader, farmer, scientist, politician, or housewife—has willingly submitted to coercion. We want to retain our essential freedom to be enterprising in our economic activities. Today we have achieved the objective of full employment through the methods of war, which are the methods of regimentation. With the ending of the war, we must learn how to achieve the same objective through the democratic methods of peace.

THE first and most important step is to give immediate attention to markets. Markets is just another word for demand, and this approach has been briefly discussed in the foregoing. The second step concerns the process of unwinding our economy from its wartime basis back to a peacetime basis. To do this successfully, it is clear that there must be some agency to which individuals and corporations can turn, not for orders but for information and advice. Such an agency should be able to provide answers to questions like these: What will be the policy of the various government agencies regarding the disposal of surplus government commodities and merchandise? How soon and on what terms can a business man acquire a government-built plant which has been tagged for disposal? What is the total potential demand for his product? How does the productive capacity of the industry stack up against this potential demand?

WHEN the business man has appraised the estimated demand for his products, the competition he must face, the availability of materials, and the price of labor, then he is in a position to make practical plans regarding the future of his own business and the future of his employes and others dependent upon him.

What are some of the ways in which this need for information can be met?

1. The American Federation of Labor has suggested that the War Production Board has complete data on industrial resources for war work, and should therefore be commissioned to continue operating and cooperate with private business in getting the facilities converted. This procedure has the advantage that it could be put into action most easily, since the instrument already exists. However, one disadvantage is that the War Production Board is composed of business men who will be anxious to return to their own businesses, and whose skill and knowledge will be needed by those businesses in the task of reconversion.

2. Another possibility would be to use the established facilities of trade associations. However, this would be open to the objection that many lines of business are not adequately covered through such associations.

3. A further possibility lies in action through the Department of Commerce. This agency is well established, impartial, and is increasingly earning the respect of business men. It already has acquired and publishes a wealth of important and useful information. It could take over much of the in-

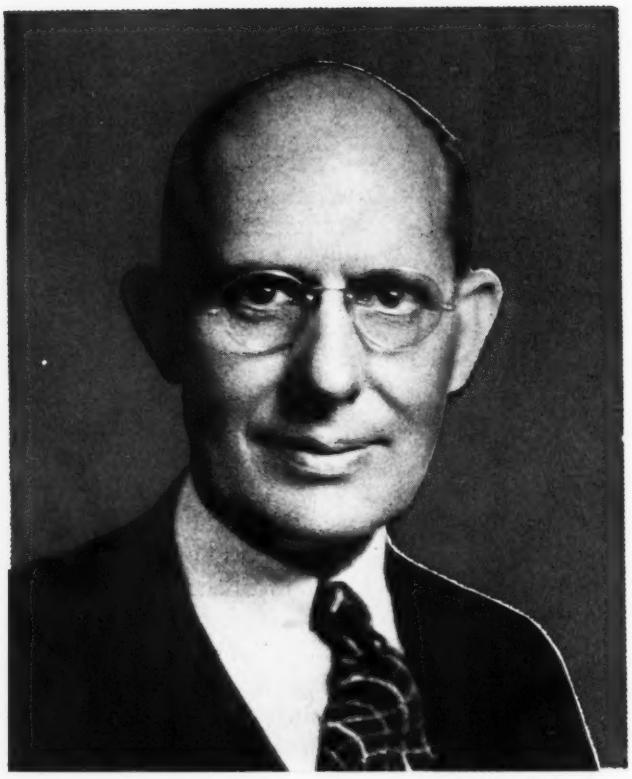
formation developed by the War Production Board. Under such a procedure, the Department would be rendering to business much the same kind of service that the Department of Agriculture renders to farmers, with no compulsion on the individual company.

VARIOUS objections can be raised to all these suggested procedures. What is imperative, however, is that business should have a definite point of view, first as to how the immediate conversion problem should be handled, and second as to how we can best deal with the longer range problem of maintaining a steadily rising standard of living free from the violent instabilities of the past.

Once individual plans have been formulated, it will be necessary to proceed with the actual steps of preparation for peacetime production. Some of these steps are actually taking place at the present time wherever a war development has, in itself, a peacetime application, or wherever the changing needs of war require the production of civilian goods for home consumption and for occupied territories. The ultimate goal of such preparation would be to have facilities for civilian production ready in sufficient volume so that returning soldiers and released war workers could be immediately transferred from the war to the peace job, without a gap of more than a few weeks' duration.

AS a practical matter, successful post-war planning obviously cannot be the domain solely of business. To be successful, there must be joint action among the four elements of the national economy—namely, agriculture, business, labor, and government. The keynote of the thinking and action of all these groups should obviously be in terms of economic expansion, of an economy of abundance.

While not neglecting to appraise such important matters as parity payments to farmers, social security, anti-trust action, fiscal policy, and the provision of a required volume of worthwhile public construction projects, the important consideration is that the plans of all groups develop a positive rather than a negative approach, with emphasis upon more goods and more jobs for all. This is the road toward a higher standard of living, real security, and freedom.



Blank & Stoller, Inc.

By CHARLES F. KETTERING
Vice-President in Charge of Research
General Motors Corporation

THE question is often asked: "When the war is over, how long do you think it is going to take the automotive industry to change back to peacetime production?" To that question it is not possible to give a definite answer. The automotive industry is anxious to turn to peacetime production as rapidly as possible, so that its employes will have work and the public can get their much needed cars. It is just as important to the automotive industry to have people employed at good wages as it is to the workers themselves.

How long it will take to get back to peacetime production, however, will depend largely upon when and how the war ends. If it became quite evident five or six months in advance that the war would end at a particular time, then there would be an opportunity to readjust industry gradually to peacetime work and the Government could advise manufacturers when to start reconverting. On the other hand, if the war should stop suddenly, the problems to be handled would be more difficult. Let us not forget this, however: The same brains and the same ability that made it possible for the automotive industry to convert to war production in record time will be applied to putting the industry back on a peacetime basis.

TOO fixed long-range planning can be as useless and ineffective as no planning at all, because all plans presuppose certain assumed conditions; and if the conditions prevailing at the time of reconversion are not according to the assumptions, then the whole plan may be useless or even detrimental. What really is needed is half a dozen plans, each one presupposing a different set of conditions created by the manner in which the war ends.

The military requirements during the last few months of the war will largely determine the pace of reconversion to peacetime automobile production. Don't forget that it is the public that directs the manufacturer. You cannot make plans that ignore the public's taste and demand for cars, nor can you always accurately predict what the buying public is going to like, particularly after the public's habits have been upset as much as they have during this war.

We had no long-range planning for converting to war manufacture, and yet we have done a pretty good job. While planning is always useful, I place more faith in the ability and brains that did the conversion in the automotive field on short notice. They can also plan the reconversion on short notice. Hence, by all means plan, but make the plans flexible.

WE have two kinds of people who talk about what is going to happen in the post-war world. There are those who look into a crystal ball and see a world entirely different from what we now have, and those who look ahead into the great cold spaces where worlds go when they are finished. I don't believe either one of them is right. I don't believe we will have a new world or a much different world from what we had before the war, nor do I believe that our present world is going "all to pot." The main factor we will have to deal with after the war is the rate at which human beings can be adapted to change.

Before the war, many people thought that we had reached the saturation point in invention; and yet we had a surplus of men, money, and materials. The only things we were shy of, as I see it, were projects, ideas for new enterprises, new products that the public would like and want, and new ways of providing useful employment so that people could buy these things.

WHATEVER is produced in the future in the way of innovations will have to be developed, the same as in the past, against great resistance, because people do not like to change their minds. When some of our greatest inventions were brought out, there were very few people who could see any real use for them. That was true of the steam locomotive, and of the telegraph and telephone. Even the automobile struggled along for many years before the public really accepted it. In fact, nobody thought it would be of any use; that's why it came to be called a "pleasure car."

Nevertheless, the building of automobiles became one of the largest industries, if not the largest, in the country as regards employment; the automobile business is not simply the manufacture of automobiles; it is road-building, gas filling stations, dealers, hot-dog stands, and scores of other things.

We hear a great deal about individual initiative and free enterprise. I like to use the expression "free competition." Competitive business, to my way of thinking, is quite a different thing from what it has been claimed to be. A competitive business is one that is run by the customers—the kind of business that you are able to operate successfully exactly in proportion to your ability to please your customers.

There is no need at this moment to worry about what we will have after the war in the way of automobiles or refrigerators, or steering gears or anything else, if we allow the fundamental factors of competition to prevail throughout business. If you have faith in your customers—that means, if you have faith in the people—you know that they will support that business which gives them the most for the money they are willing to pay.

A GREAT many post-war planners ask: "What is the post-war automobile going to look like?" I don't know. We are too busy with war work to worry about that. The only thing I know is that if we keep competitive business, industry will produce the best of everything that it knows how to produce —whether it is in automobiles, radios, or anything else. The war has shaken us out of many ruts, and we are not going back into the old ruts. Beyond that, at the present moment, there is little that can be said, except that we will have progress, provided we encourage competitive business.

A lot of people show us nice pictures of plastic automobiles. I don't know whether you will want a plastic automobile or not. Doubtless a few of them will be made, and the customer will try them out, because he is the boss. To make specific predictions is a precarious business. In spite of the post-war wishing and dreaming of newspaper and magazine writers, it is likely that at first automobiles will be very much the same as they were before the war. No manufacturer

has had a chance to experiment and develop new cars during wartime. Even though the designers may have had ideas, they had no materials with which to try out those ideas. But competition will foster research and development.

THERE are those who think that the Government should go into the research business. That would be unfortunate. Industry has done a very creditable research job up to the present time. Why should anybody think a Government bureau could do a better one? We will make progress more rapidly in the future than we have in the past—not because we are any smarter than people were twenty-five years ago, but because we know more to start out with. Both governmental and industrial leaders, however, should remember that the getting of ideas is not a mass production business.

Some of the things that will make development and progress in the automotive field easier and more rapid in the future are the better materials with which we can work. We will have an abundant supply of aluminum; we will have newly developed alloy steels; there are great possibilities in plastics and plastic woods; and there will be new applications of synthetic rubber—to mention only a few of the things that will contribute to automotive development. The industry can convert rapidly to peacetime production because of its experience in the past of changing from model to model. Beyond this, it is difficult to say what the automotive industry will offer; but it will produce what the public wants.

I BELIEVE that the future can be almost anything we want to make it; and if, in our planning, we take into consideration the chief factor involved in building the future —people—then we can go ahead and do a good job. If we do that, our course will be not a wishful thinking course, but a course that will get us to the destination we want. I believe that with the energy, the faith, and the determination which this war has proved that free men of all nations possess, we can carve out of the future almost anything that human imagination can think of, provided it is worth while carving out and provided we are willing to work for it.

By WILLIS H. CARRIER
Chairman of the Board
Carrier Corporation

POST-WAR planning in the air-conditioning and refrigeration industry possibly presents somewhat different problems from those met with in a number of other industries, because the equipment and services furnished by this industry are likely to be in considerable demand as soon as the war is over. It is not possible to make predictions relating to conditions too far in the future, but the indications are that there will be an active demand for the products of this industry for two years, at least, immediately after the war. Most likely, this demand will continue after that period as well.

For that reason we expect that this industry, in general, will be able to maintain employment for at least as many people as are now being employed in this field and probably more—perhaps 15 to 20 per cent more. This does not mean that there may not be a temporary drop in employment for a brief period while the industry readjusts itself to peacetime conditions; but this readjustment should be easier in the air-conditioning and refrigeration equipment industry than in many other fields, because this industry has been employed in making equipment for the Army and the Navy similar to its peacetime products. Hence, if there is a temporary drop in employment, this will probably be recovered within the first year, and employment should reach a peak in the second year after the war.

Another favorable condition—and this applies to all industries—in regard to the employment situation is that, as far as we can now judge, the war will not end suddenly in all parts of the world. Presumably the war in Europe will be over first, and that in the Pacific and Asia somewhat later. This will give the industries now engaged in producing for the Army and Navy an opportunity to return gradually to peacetime production.

GOVERNMENT policies in effect immediately after the war will have a marked influence on industrial activity. Perhaps the most important of these policies in their immediate effect will be those governing the disposal of the Government-owned plants and their equipment. If the Government follows a policy of temporarily retaining and gradually disposing of plants and equipment, it will greatly aid the readjustment of industry to peacetime conditions, and will accelerate the speed with which in-

dustrial plants will be able to re-enter peacetime production. It is important that these policies be clearly and precisely defined. Uncertainty in regard to them will have a most deterring effect on private enterprise.

Another important question is how long the Government will maintain control over materials and over industrial operations in general. It is likely that rationing of materials will have to be maintained for a period after the war, until industrial demand is stabilized. Here again, however, a clear-cut definition of Government policies is important, so that industry will know what it may count upon; and the controls should not be maintained any longer than absolutely necessary. The sooner private enterprise regains full control over its activities and the sooner Government returns to its normal functions, the better.

MATERIALS for peacetime production should be plentiful soon after the war demand begins to taper off, because our total production of iron and steel, as well as nonferrous metals and many other materials, is so much greater than it has ever been before that as soon as the war demand slackens, even to a slight extent, a considerable volume of materials can be released for peacetime uses. For example, when the war is over in Europe, even though it continues in the Pacific, war production is not likely to require all the materials being produced, and peacetime production of capital and consumer products can be gradually resumed.

A NUMBER of new developments took place during 1940 and 1941. Of certain types of equipment, however, only a few installations were made. Then these peacetime developments were arrested because of the sudden demand for equipment for the Army and Navy. There has been little opportunity to carry these developments further, but as soon as the war is over, they will be pushed ahead. Some of them date from about 1938, and came into practical production in 1940 and 1941, but not on the large scale that may be expected after the war.

IN addition to these arrested developments, there are the important developments that have taken place during the war because of the unusual requirements for equipment for Army, Navy, and war plant needs. How important some of these will prove for peacetime requirements it is not possible to predict accurately, because sometimes equipment that would appear important turns out to meet with a comparatively small demand, whereas something that seemed unimportant may later assume large proportions.

OUT of the war effort, however, there have come two or three developments that appear to be significant. Progress in these directions might have been much slower but for the war. Peacetime demands would not have been large enough to warrant the development expense. Now that the pioneering work has been done, however, its introduction for similar purposes during the coming years is much simpler.

As an example, large-sized centrifugal compressors, first developed to cool water for air-conditioning, are now performing services that were not expected a few years ago. Experience has been gained with higher compression ratios than formerly. The experience with operation at very low temperatures and a greater temperature range in each compression stage has also been achieved. These applications, coupled with the use of larger units, have resulted in lower first cost for equipment and reduced operating expense. This especially applies to high-pressure refrigeration equipment with high-compression ratios that has been made available for low-temperature use—for operation in sub-zero ranges. New refrigerants have also been developed in this connection.

THE petroleum industries will offer a large field of activity involving refrigeration equipment. The petroleum producers have really become chemical companies, offering great post-war possibilities. The chemical products made from petroleum will be processed and handled by the petroleum companies themselves, and this, in turn, should

offer a considerable outlet for refrigeration equipment and large centrifugal compressors, suited for these new requirements.

IN the air-conditioning field considerable activity may be looked forward to in installations for office buildings, hotels, large apartment houses, theatres, stores, and restaurants. The air-conditioning of the private dwelling house, however, is not likely to prove of great immediate importance.

While there will always be a demand for room cooling units, it is not likely that the owner of the ordinary medium- and low-priced home will consider the expense for complete, all-season air-conditioning justified. There are many other things that he would consider more desirable in the building of a home than a comparatively expensive air-conditioning installation. To meet the requirements of the ordinary low-priced home, the air-conditioning equipment, including refrigeration for cooling, should not cost more than $500 to $600, covering the cost of marketing and installation. Means are being sought to supply air-conditioning equipment at this price level which, if successful, will substantially broaden the field in home air-conditioning.

AIR-CONDITIONING of industrial plants will continue to be an important factor. It has been said that on account of the great number of plants that have been built for war production, there will not be a great deal of industrial building after the war. This is not necessarily correct. Many of the buildings erected for war purposes are neither in the right locality nor of the right kind for the production of peacetime goods; hence, industrial building activity is not likely to cease, and additions to plants that were not enlarged for war work may be expected.

Industrial managers have been educated during the war to the value of air-conditioning. Furthermore, there is likely to be a marked increase in the "blackout" type of factory—that is, the windowless building which, with uniform lighting, air-conditioning, ventilation, and humidity control, can

be made an ideal work-place. One factor often overlooked in favor of the windowless factory is that there is no window maintenance. The cost of windows and their maintenance runs into large figures.

The windowless factory offers also many production advantages. Moreover, the absence of windows in a factory may reduce both the first and operating costs of heating, as well as air-conditioning, as much as one-third to one-half.

LAST but not least, the marked development during the war period of standardized units for refrigeration and air-conditioning should be emphasized. The use of these units not only reduces first cost and maintenance expense, but provides simpler operating conditions, increases available space in refrigerated rooms, and eliminates much cumbersome and unsightly piping. Self-contained refrigeration and air-conditioning units will, without doubt, represent one of the important factors in the post-war activities in this industry. They will make some applications feasible that up to the present time have not been thought possible. The combination of automatic control of temperature, humidity, and ventilation in connection with self-contained units offers great possibilities in the future.

By M. W. SMITH
Vice-President in Charge of Engineering
Westinghouse Electric & Mfg. Co.

THE No. 1 job of industry is to win the war. That end has been and is being prosecuted to the best of industry's ability. But while we are fighting the good fight against the powers of evil that are endeavoring to destroy the civilization that has been slowly developed step by step for a thousand years, we may well give some thought to how the ideals and principles for which we are fighting can be preserved when the war is over.

We are fighting for individual freedom and for satisfactory social and economic conditions. All of this presupposes at least normal employment; hence our job when the war is over will be to replace war activities by new jobs, new ideas, new products, and new applications. Plans to meet these requirements must be laid now. It would be too late to begin to think about them after the peace treaty has been signed; unemployment, suffering, and chaos would be the inevitable result.

Those who think that post-war planning now is premature do not appreciate how long it takes to lay the groundwork for industrial activity. Actually, the average industrial development requires about seven years from the idea or invention stage to its full practical application; hence the importance of giving thought to the future at this time.

THE specific form that some of the new developments will take and the fields and applications that will be immediately concerned are difficult to predict. However, it is possible at this time to indicate a few of the trends that may be considered representative of post-war technical improvements in a number of fields.

Post-war developments in power generation will probably come from many directions. Because war equipment is quite generally constructed of heavier and thicker materials than commercial peacetime equipment, less power per pound is required to produce it. For example, the production of steel for automobile bodies and fenders requires much more electrical energy in the steel mill than a corresponding amount of steel for tanks using heavy armor.

Progress in the further development of steam units will be gradual, but it will be sure and steady. Turbo-generator units rated at 100,000 K.W. at 3600 R.P.M. appear to be obtainable without exceeding normal margins of safety and reliability. A great deal of progress has recently been made in the development of high-strength materials for high temperatures. To obtain high output along with light weight in gas turbines,

such as those used for driving superchargers, a still more intensive development in this field is now under way.

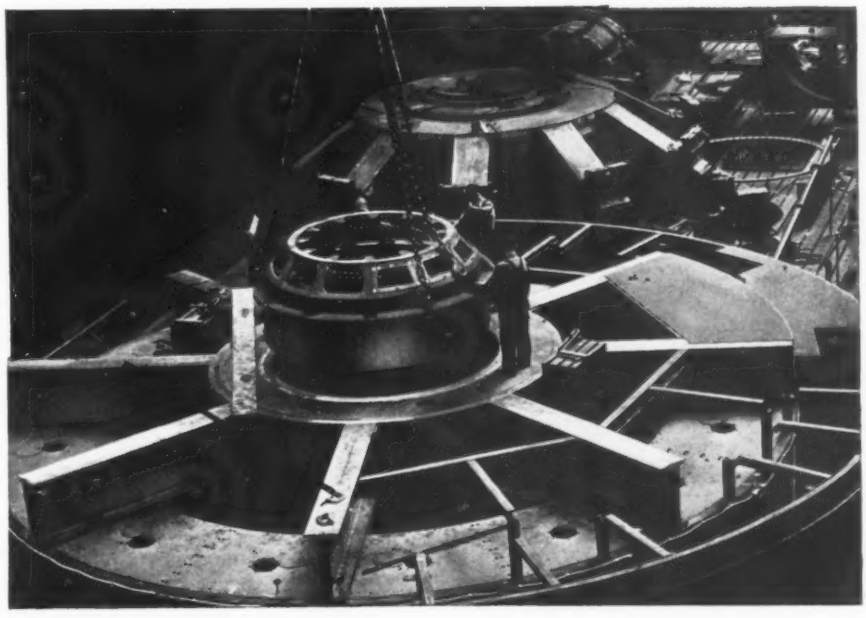
MUCH of this work must be treated confidentially from a military standpoint; but in the interest of accelerating the war effort, several industrial and technical associations are now pooling their knowledge and experience so that rapid advances are being made. The results of this work will be instrumental in extending the limits of operating temperatures and performance of various forms of prime movers.

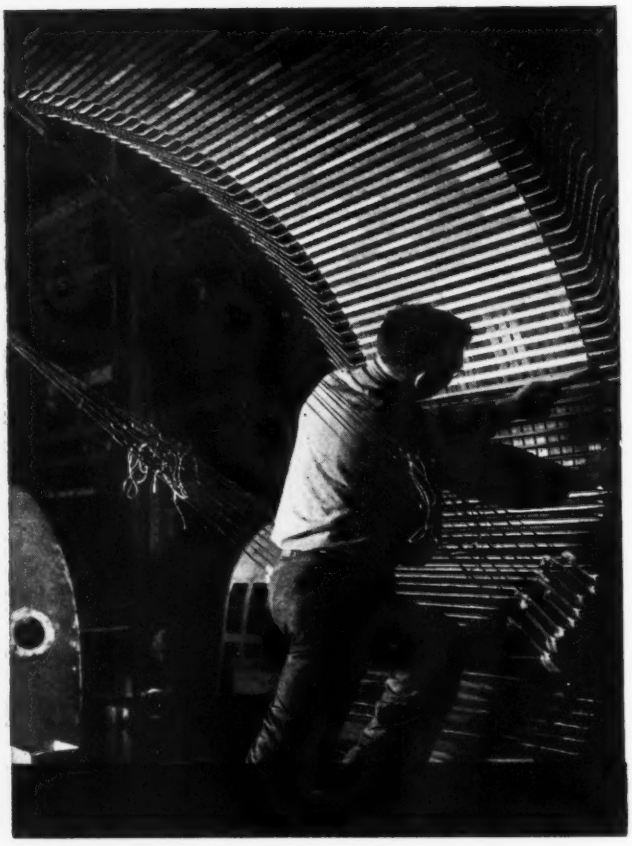
As a result, the development of commercial gas turbines for peacetime applications may be much more rapid. The initial step will probably be in the use of small high-speed geared units of, perhaps, 3000 K.W. at 15,000 R.P.M. These gas turbines would be of the open-cycle type located near load centers close to the point of utilization of the electrical energy. Such prime movers would also be convenient for small generating plants. Possibly utility companies may desire to supply, or at least operate such plants for their industrial customers, so as to give the best over-all power service.

For power requirements in main power stations, a battery of small units may be used, with the individual units started and stopped by push-buttons, thereby obtaining peak efficiency. A second and larger step may be in large-capacity individual gas turbines of the closed-cycle type, complete with heat exchangers and having efficiencies approaching modern steam units, along with weight and space reductions that might make them available for ship drives.

THE long-distance transmission of power from large hydro developments offers opportunities for direct-current transmission. The future progress is still dependent on the development of economical and practical tubes for converting the generated alternating current to direct current, and then recon-

*Based on an interview by the Editor of MACHINERY, and on additional data recently published by Mr. Smith in *Electric Light and Power*





verting it to alternating current at the receiving end of the line. Developments for war needs are contributing to tube improvements that are likely to be applicable for this, as well as for other purposes.

MOST of the new developments in electronics are being applied to military uses, and are still in the secret category; but it is apparent that the new radio circuits, vacuum tubes, and various other electronic devices will find a large number of peacetime applications. For example, many of the recent improvements are in the same frequency range as television, and it is now obvious that the knowledge being accumulated will add materially to developments in this field. Other electronic developments promise to become important for the indication and control of certain phases of chemical analyses and processes, as, for example, those used in the production of petroleum and synthetic rubber.

The Precipitron, an electrostatic type of air cleaner, has already established itself for the purpose for which is was originally developed. However, recent tests show promising possibilities for its use in combination with mechanical filters for application to large power stations and industrial plants.

Another promising outlook for electronics is in inductive heating. These possibilities vary all the way from the processing of so-called non-conducting materials, like plastics, plywood, and shoe soles, to the annealing and heat-treating of steel and other conducting metals. A recent example of progress in this field is found in the high-frequency heating of electroplated tinned strip, whereby the amount of tin required for tinning is reduced by 60 per cent.

WITH existing traffic demands on the railroad, equipment is used to the limit of its capacity under conditions that make it difficult to provide normal high standards of maintenance. An abnormal rate of equipment deterioration is consequently inevitable; at the same time, the increased traffic is providing a source of increased revenue. Both of these conditions should encourage purchase of new railroad equipment.

Studies of electrified roads show the prospects of real worthwhile improvements in equipment for both the locomotives and the power supply and distribution systems. The high sustained running speeds and faster operating schedules maintained by Diesel-electric and straight-electric locomotives have demonstrated their advantages.

The demand for increased power at high speeds is now exceeding that available from reciprocating steam locomotives. The solution may be found in the recent development of turbine-driven locomotives, with the turbine geared directly to the drivers. A locomotive of this type has been carried through the design stage and is now approaching the next stage of manufacture and experimental testing. It will have a rating of approxi-

mately 6500 H.P., and will use some 25 per cent less steam per horsepower hour than the conventional reciprocating steam locomotive. The high-speed gas turbine also offers the possibility of another form of motive power for locomotives.

A most interesting development is under way to provide riding comfort. Experiences in the war disclosed the need for holding guns on tanks steady while the tank was in motion over rough terrain. According to General L. H. Campbell, Jr., Chief of Ordnance, a specially developed device for this purpose is said to improve the accuracy of the M-4 gun fire more than five times. A 75-millimeter gun can be fired when the tank is in motion and hit the target. In view of this development, it appears reasonable that some form of stabilizing system can be worked out and applied to railroad cars, so that even at high speeds it will be possible to obtain smooth operation on rough track with safety and with a marked reduction in the work needed for track maintenance.

IN the aviation field there will be improvements in instruments, engine control, and navigation equipment. From the beginning, internal-combustion engines have been the accepted source of power for planes. It is now reasonable to predict that in the post-war world, gas turbines operating at high speeds may be made light enough to drive commercial and cargo plane propellers through suitable gearing. Looking even further ahead, a step of particular interest in the electrical field will be the possibility of using an electric drive between the gas turbines and the propellers.

LAST but not least, in planning for post-war activities, we must remember that the regular lines made by manufacturers have been discontinued for the duration. The first thing that the electrical industries will do will be to reconvert to the manufacture of household electrical equipment, such as refrigerators, ranges, washing machines, vacuum sweepers, electric irons, toasters, etc. For these, there will be a great dammed-up demand.

At first, these will be made in the same models as before the war. There will be no attempt to make radical changes; rather, the improvements will be made gradually. If an attempt were made to bring out new designs, new tools and manufacturing equipment would have to be provided, and this would delay production. The household equipment made by industry was up-to-date at the beginning of the war, and brand new models are not required immediately.

THE preceding paragraphs merely attempt to outline a few of the possibilities by which industry, freed from wartime restrictions, will be able to serve the American people through filling its normal function of providing goods and services, while also furnishing employment for the largest number of people possible.

Photo John Haley

By E. E. WILSON, Vice-Chairman
United Aircraft Corporation

IT may seem paradoxical, but it is nevertheless a fact that the industry with the broadest horizons is the least able to make definite post-war plans. The future of the aircraft industry, like its past, is closely identified with the Government's policies and actions. Furthermore, its rate of expansion over the last four years is unparalleled. From a yearly production valued at $200,000,000 in 1939, its production in 1943 is expected to reach about $20,000,000,000—a hundred-fold expansion. Of this, the old-line aircraft companies expect to account for $12,000,000,000—or about three times the pre-war automotive industry peak. The industry's problems are in proportion to the magnitude of its expansion.

There are three major factors of predominant post-war interest to the aircraft industry: First, termination of war contracts; second, disposition of surplus stock; and third, disposition of surplus plants. The solution of the problems requires statesmanship and leadership of high order. The action of Congress on these three matters may either promote or jeopardize the welfare of a large number of people. This includes not just those directly or indirectly dependent upon the aircraft industry, but all the war industries as well, because fundamental principles are involved.

ON one hand, we may look at surplus stock and plant from the business point of view, and think of it as inventory or plant account, to be liquidated in a forced sale. On the other hand, we may look at it as expendable, like the war products already expended against the enemy. Each individual situation will have to be viewed on its merits between these two extremes, but the governing principle is that this is the property of the whole people, and should be disposed of in their best interest.

THE public interest demands that jobs be kept available. This, in turn, requires a prosperous industry. We saw what happened after the last war, when disorderly termination produced chaotic conditions, surplus war stocks destroyed markets, and Government competition with private industries ruined certain of them. These factors should be administered to promote private employment, not to hamper it.

In the absence of definite pronouncement on the part of the Government with regard to the termination of contracts and disposal of surplus stocks and plants, the aircraft industry finds it impossible to make definite plans for its post-war activities; but there are four fundamental rules that will aid industry in holding its own under all circumstances: (1) Do the current job to the best of the

ability of the organization. (2) Handle finances with care, with an eye to future needs. (3) Take advantage of technological advance, and make use of all new and improved facilities. (4) Avoid deterioration of the organization because of pressure for speed regardless of cost.

APART from the policies adopted by the Government on the matters referred to, the Government can greatly aid both the aircraft and all other industries by terminating its controls at the earliest feasible moment. The sooner industry can resume operation as free individual enterprises, the better for the public welfare. There is no substitute for the self-reliance and resourcefulness of the individual. Planning cannot be made according to a set pattern, and no master minds can plan for industry as well as the thousands of capable men who are engaged in manufacturing. The miracle of production that we have seen in this country since the beginning of the war could not have been planned by any one man or small group of men. It is the result of the freely exercised ingenuity, judgment, and enterprise of tens of thousands of men.

AS to the future of the aircraft industry, the possibilities seem interesting, to say the least. We have entered upon a new era of transportation by a means that knows no boundaries. All former methods had such boundaries. Railways and highways end at the sea; sea lanes, at the shore; for aircraft, there are no such physical limitations—economic factors are the controlling ones.

International transportation can grow. Improved air fields and the use of feeder lines should make public transportation easier and quicker. The possibilities of the private use of aircraft are as yet unexplored. Some believe that the return of thousands of skilled pilots will influence development in this direction. The helicopter, obviously, has interesting possibilities. It competes with neither the airplane nor the automobile, but seems rather to supplement them both.

FUNDAMENTALLY, the future of aviation depends upon how well we rediscover the principles of individual initiative and enterprise, and how well we direct the efforts of Government toward utilizing them in promoting the public welfare.

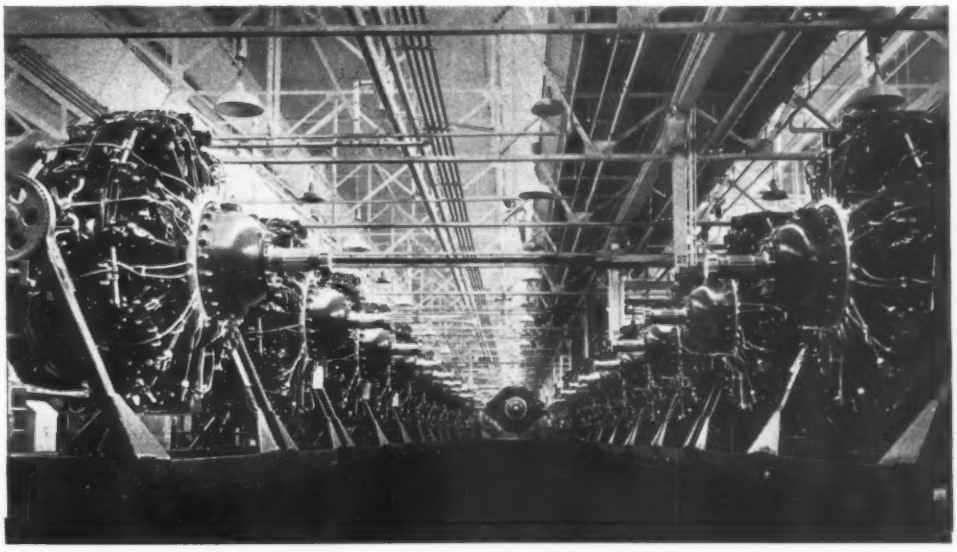


Photo Root, Chicago

By J. L. McCAFFREY
Second Vice-President
International Harvester Co.

THE post-war planning activities of the International Harvester Co. are carried on in the fields of engineering, manufacture, distribution, finance, and employment, as well as in allied branches. Obviously, none of the post-war planning activities are permitted to interfere with the prosecution of the company's war production program. The post-war planning work is carried on by a central committee, of which the writer is chairman. An executive of the company gives his full time to acting as secretary of the committee. The detail work of the committee is carried on by several subcommittees.

Our company is frequently asked about plans for the development of new and better types of farm equipment for the post-war period. These post-war plans are, in some instances, definite and detailed, well along toward fruition. In other directions, we have not yet reached the matured stage, but have settled on the goals we hope to reach. While we are planning just as carefully for the post-war development of our motor truck, industrial power unit, refrigeration, and other lines of products, I shall discuss here only farm machines.

WE approach the development of post-war farm machines with five basic considerations in mind:

1. While agriculture after the war may be different in many respects from what it has been heretofore, the fundamental purpose of farm machinery will remain the same—to enable the farmer to produce more food with less effort and at lower cost. The immediate job of American agriculture, both now and for several years after the war, will be to produce an abundance of food to tide us over one of the world's great food crises. Adequate, economical farm machinery is a basic requirement for that job.

2. We believe that a cardinal need of American post-war agriculture will be farm machines possessing maximum efficiency at the lowest possible cost, especially the type to fit family-sized farms.

3. We believe that the rapidly changing techniques in the culture of crops, the wider diversification of crops grown by farmers, and the introduction of crops new to the American scene will create demands for new types of machines.

4. Engineering, scientific, and mechanical advance will make it possible to build farm machines after the war of simpler design—much easier to handle and much more precise in their operation.

5. We are certain that out of the mass of new manufacturing technology acquired by American industry as a result of war production will come new manufacturing methods, the use of new and better materials, and other improvements that will enable us to produce better farm machines.

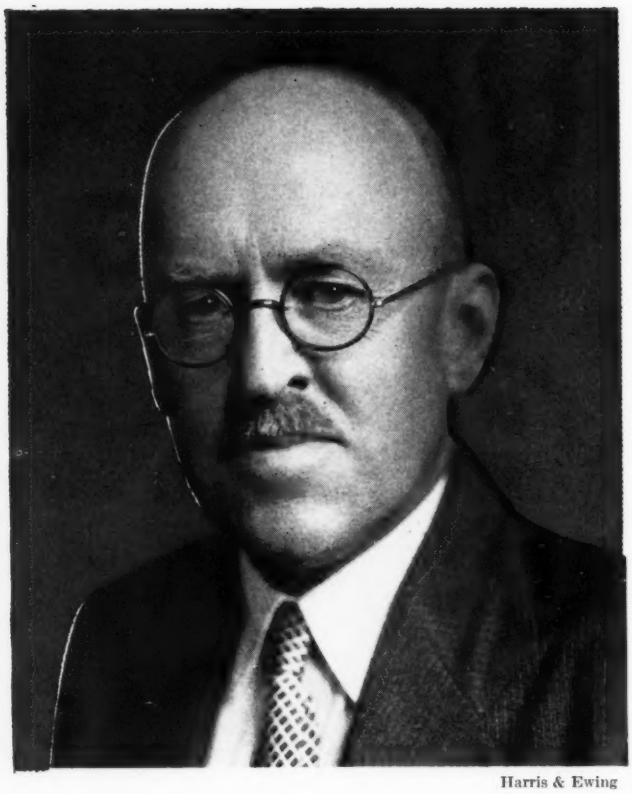
I CANNOT speak now of individual machines, except in instances where designs are practically matured. We have given careful consideration to applying mechanized power to the handling of crops for which such power has not been available in the past. An example is the development of a successful mechanical cotton picker. This machine probably will not be produced in quantity until after the war, because it requires a considerable volume of materials per machine. But the cotton picker in its present form is ready for commercial utilization—a few are already in the hands of planters—and we anticipate that in certain cotton-growing sections of the country, this machine will be an important post-war development.

Likewise, for many years our industry has sought to develop an economical, successful sugar-beet harvester. Progress is being made toward this objective, and it may well be that a beet harvester will be another important post-war farm machine.

THERE has been great technological change recently in the handling of the hay crop. Machines for use on the hay crop have kept pace with the changes in the manner of handling the crop. Our company has some new types of hay machines that we may introduce before the war is over. We are constantly working on tractors, with the goal of making more power available to farmers and applying it more efficiently to their machines. At present we are doing a great deal of work with the self-propelled combine to meet current farm needs.

ASIDE from these machines, which are already well matured, we expect many significant post-war changes in farm equipment design, construction, and performance during the first decade after the war; but we do not expect to see all, or even very many, of these changes in the first year or two after the war for the following reasons: First, because new types of farm equipment require thorough, exhaustive testing. That is a time-consuming process. Second, because changing over from present models to quite different models requires large-scale retooling, another time-consuming process.

OUR over-all objective will be to make more and more mechanical power available to the owner-operator of the smaller farm, and the machines to go with it. For the last ten years, the most striking development in our industry has been the rapid appearance of machines suitable for the smaller farms. We are certain that this trend will continue. In that way, American farms will remain a great mass market for the products of American industry.



Harris & Ewing

By RALPH E. FLANDERS, President
Jones & Lamson Machine Co.

THAT the future of the machine tool industry is a dubious one is quite generally understood. The problems that have to be faced have had a good deal of publicity, particularly in connection with Congressional hearings on renegotiation. The peak volume of shipments in past peace years has fluctuated slightly above and below the $200,000,000 mark. This was the case in 1918, in 1929, in 1937, and again in 1939.

In 1940, when the Allies started their war production with strong dependence on American output, the sales of the industry went up to the unprecedented volume of about $440,000,000. When our own war preparations got under way in 1941, it rose to approximately $780,000,000. In 1942, it was more than $1,300,000,000, and for 1943, on a decreasing output, it will still be over $1,100,000,000.

WHEN we consider that the tools produced in the last four years have been more productive and far more durable than any produced in past periods, the size of the available supply of machine tools after war production ceases is disturbing to contemplate. At the end of 1939, we had about $1,500,000,000 worth of machinery not over thirteen years old. At the end of 1943, we had nearer $4,500,000,000 worth, or three times the amount of machinery in good condition that we had at the end of 1939.

It is true that the number of machine tools will not be three times as great, since prices per unit are higher now than they were in the previous period. It is safe to say, however, that the productive capacity per thousand dollars of cost is even greater now than it was then, in spite of higher prices. In other words, the productive capacity of machine tools has gone up faster than the price has risen.

IN the face of this situation, what are the prospects for continued prosperity of the industry? This question is not only serious for individual companies, but it has also given concern to banking and other financial institutions who have made their own independent studies of the problem. The problem is one we have to face, and as we face it, we find that there are a number of things that can be done about it. I propose to touch briefly upon some of them.

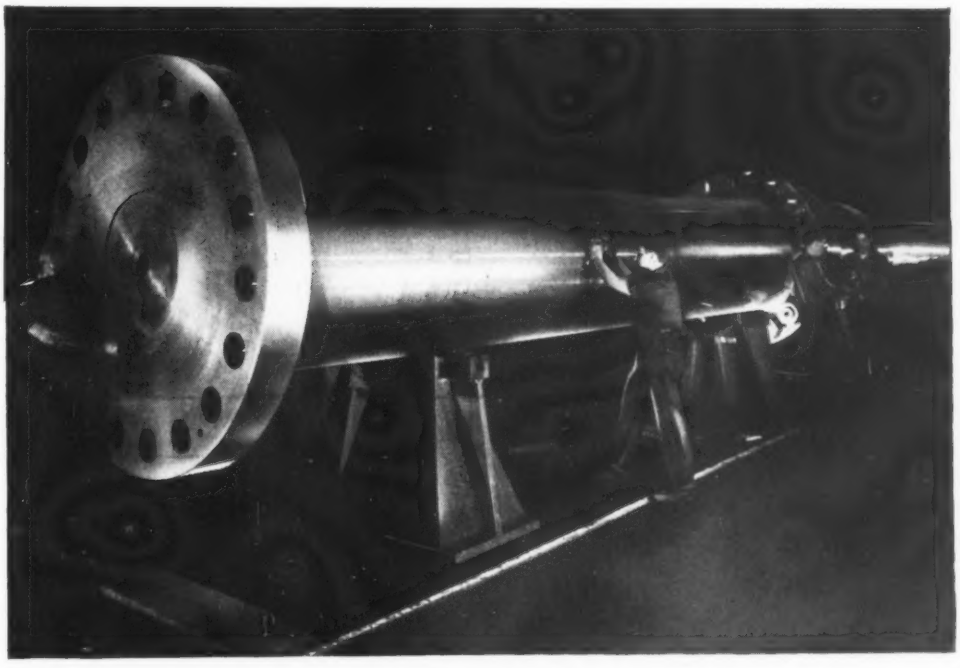
If our military policy is wisely determined —and there appears to be no reason to fear otherwise—a certain proportion of the present specialized productive plants for such things as airplane engines and planes, guns of various types, torpedoes, ammunition, tanks, etc., will be retained intact as our first

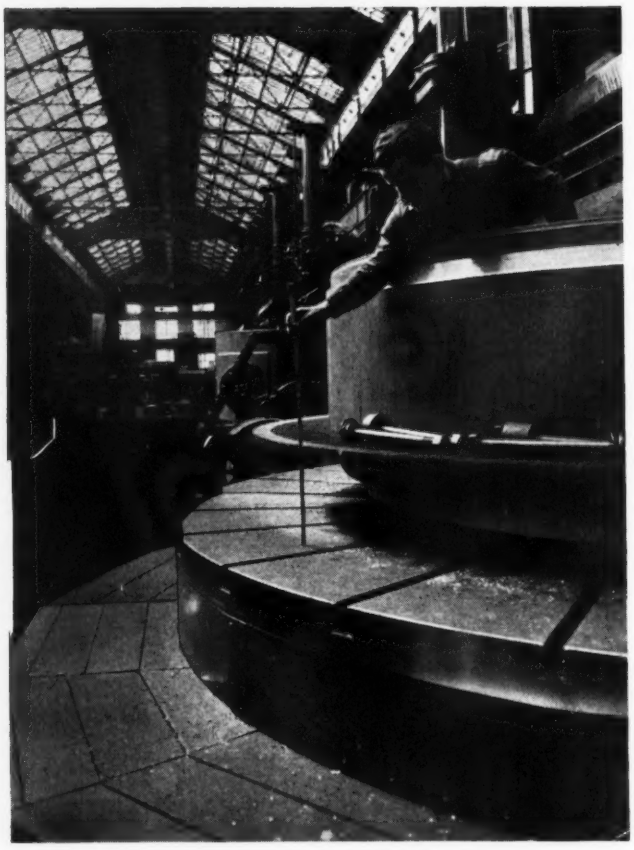
line of defense and preparation for warding off future threats to world peace. It is true that in the interim, designs of product may change, but for the most part, the basic machinery, retooled as may be required, will save not weeks or months, but possibly years, in getting a new war program into action. The presence of these complete plants, held always in readiness, will be an important insurance against the necessity of their being used. We may, therefore, write off these machines as not being disturbing factors in the post-war market.

THERE are other important useful applications of surplus machinery that should be made. For example, the obsolete equipment of our Government arsenals, whether in the Army or Navy or other services, should be scrapped at the war's end and replaced with surplus equipment of current design and high productive capacity. The same policy should be followed for all the manual training schools and trade schools of the country. Every school shop and every training shop should be fitted out with the most modern available machine tools.

THE above suggestions will remove a certain proportion of the surplus equipment from the market without seriously endangering our future business, and will do it in such a way that the used equipment will serve a highly desirable social purpose. Thus the surplus machines will appear as an asset in our national economy instead of as a liability.

There are other uses which can be found that do cut into our future market, and yet in the long run, they may appear as stimulants to business, rather than deterrents. First-class, second-hand machinery for the rehabilitation of devastated countries will enable those countries to recover far more quickly than would be possible if they had to wait for the building of new machine tools. The general prosperity arising from a quick recovery may prove to have a favor-





able, rather than an unfavorable, effect on the world market for newly produced machine tools.

IT is doubtful if all the proposals made so far would take care of the enormous excess volume still remaining to be disposed of. That remaining volume could, perhaps, be best distributed to American industry by the firms that made the tools in the first place. They should be redistributed in such condition and on such terms as will make it possible to eliminate the oldest equipment in manufacturing plants the country over, bringing them up to modern production standards, which is the same as proposed for the Government arsenals. If this were done, American industry as a whole would be renewed, revived, and in a finer position than ever before in its history to compete with the world.

SO much for the post-war surplus equipment. What are the opportunities for building new machinery? On examination, these opportunities appear to be not too bad for companies that have so managed their affairs that they can succeed without financial distress in reducing their operations to some reasonable advance on their pre-war size and output.

The first great opportunity will be of the type which is best exemplified in the opportunities open for new machine tools in the automotive industry. When and as the automobile builders shift back to the production of cars for the enormous dammed-up civilian demands, great quantities of new machine tools are going to be required. Investigations that have been made by different companies indicate that the equipment now employed in war work is either of the wrong kind or size for automotive production, or where kind and size are right (and that is true mostly in the case of pre-war machines), the strain of war production has so worn out these older tools that they must be replaced. We can, therefore, expect a lively post-war demand, continuing for some time, for machines of the kind best adapted to the manufacture of automobiles.

A SECOND opportunity for new business comes from the development of new designs. One characteristic feature of new designs now on the drafting-board of the industry will be their adaptability to much higher cutting speeds than are now common. This is the result of the great improvement in cutting tools that has taken place and also the extended use of the lighter materials, such as aluminum and magnesium.

Another factor requiring change and improvement relates to the much higher labor costs of the future, which will put a premium on automatic features that have hitherto been questionable from the standpoint of over-all considerations. The new machines will be provided with automatic operative means, which will not only maintain a complete automatic cycle, but will also elim-

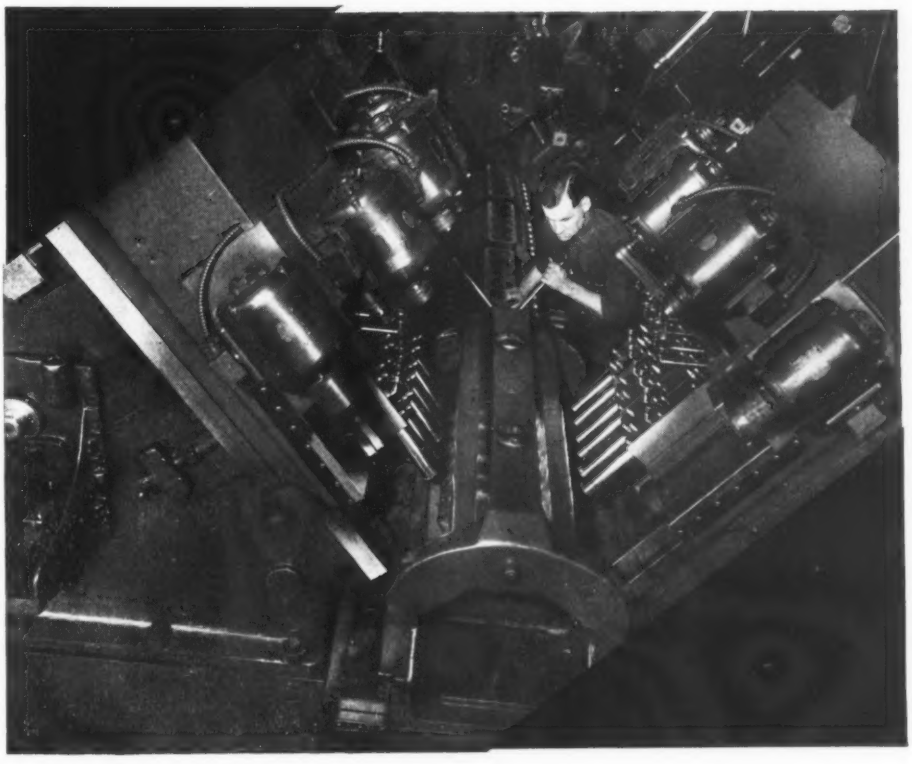
inate practically all the manipulations that have hitherto required the exercise of manual strength on the part of the operator.

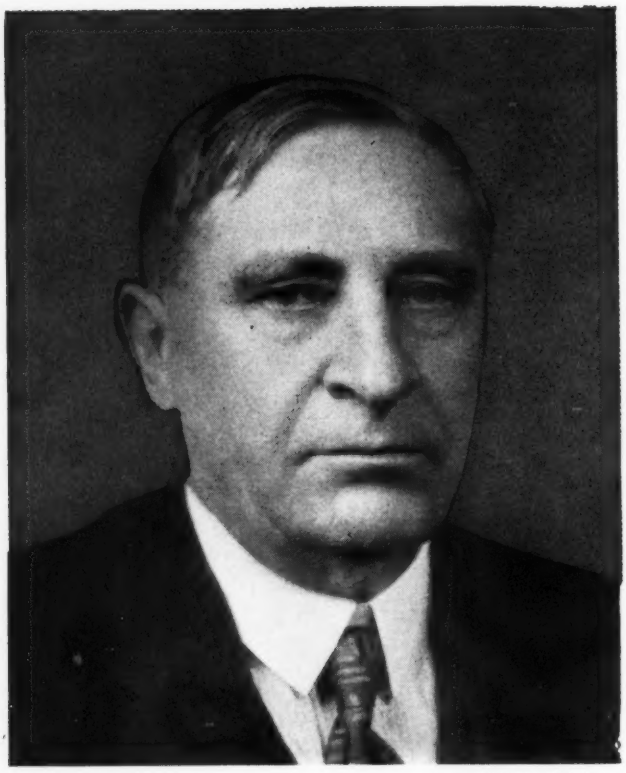
THIS is another large opportunity. The difficulties in preparing for it lie first in the continued concentration of engineering and designing ability on war work, and second in the very small reserves that most machine tool companies have left after taxes and renegotiation. The smallness of these reserves will slow down redesign and lengthen the period of low employment which may appear during the period when machine tool companies themselves are making their post-war adjustments.

The final opportunity will come from an expansion of the American machine tool market and of American methods in countries that are being newly industrialized. Among these we may safely reckon on healthy though not inflated markets in Brazil, and for a still longer pull, in China.

It is reasonable to expect that the German machine tool manufacturers will not be able to participate in the world markets to the extent they did prior to 1939, and for that reason, the export demand for American machine tools is likely to be substantially greater in the years immediately following the war.

THESE are the principal elements in the future of the machine tool business as I see them. They are full of difficulties, and they will require quick and clear thinking on the part of management. If this is provided, and if ample reserves can be saved from taxation and renegotiation, a machine tool industry of reduced but satisfactory size can be expected to operate profitably in the post-war period.





Harris & Ewing

By R. V. FLETCHER, Vice-President
Association of American Railroads

EVERY industry is busy making plans for the new economic and political order that will follow the end of the war. The Committee on Economic Development specializes on the all-important question of unemployment, as Paul G. Hoffman has recently pointed out in these pages. It has been estimated that more than three hundred agencies are engaged in research, with a view to making plans for post-war business activity in the United States.

The railroads are mindful of their obligation to look ahead to the time when war traffic has diminished and when competitive forms of transportation are again bidding for patronage. They have learned some useful lessons during the depression period of the thirties and the busy period now upon us. They entered the era of preparation for defense, and have continued through the war period, with a supply of equipment substantially below the amount in use in the first World War and the decade that followed. Restrictions upon the supply of materials and shortage of man-power have prevented the railroads from increasing the number of locomotives and cars, although traffic, both freight and passenger, has risen to an unprecedented volume.

Despite the shortage of equipment, the railroads handled, in 1942, a volume of traffic more than 40 per cent greater than the peak traffic of 1929, and at least twice as great as the amount handled in the busiest year of the first World War. This truly remarkable achievement was made possible by the cooperation of the Army, the Navy, the Office of Defense Transportation, and shippers and receivers of freight, aided by improved methods of operation resulting from large capital expenditures in the twenties and improved operating techniques.

AMONG the important lessons learned during the war is the value of volume in its effect upon revenue, both gross and net. In 1942, the railroads collected about $7,500,000,000, paid $1,198,833,532 in taxes, earned $1,484,519,296 in net railway operating income after payment of expenses and taxes, and had left about $900,000,000 after paying all interest and rental charges. Of this sizable amount, they disbursed only $200,000,000 in dividends, leaving about $700,000,000 for debt reduction, reserves, and additions to property. It is confidently hoped that the roads will emerge from the war with $1,500,000,000 in cash in their treasuries. They reduced their interest-bearing debt in 1942 by $325,000,000, and this debt-reducing program has gone steadily forward in 1943.

Undoubtedly, the railroads will need this money, and more than this if the supply of

capital is available. The post-war period will witness a revival of intensified competition. Highway traffic will come back with a rush on the new roads that are being projected. Never before have we had so large a supply of merchant vessels. New pipe lines have been constructed at government expense for the movement of oil. We are constantly reminded that air transport will be multiplied in volume and efficiency. Manifestly, the rails must be on the alert to hold their own in an economy where their supremacy will be constantly challenged.

THE future of the railroads lies in their ability to render efficient service at low cost. To bring this about, they will modernize their equipment, and increase the speed of freight and passenger trains without substantial increase in the level of rates and fares. To accomplish this, new freight cars must be built of light-weight metals and alloys, and locomotives must increase their tractive power. Grades and curves must be revised. Terminals must be rebuilt, and in some cases relocated. Advantage must be taken of every possible technological improvement, not only in equipment but in track structure as well. Personnel problems demand attention, if for no other reason than to make the business attractive to young men of promise and initiative.

Conscious of the seriousness of these and other problems, every railroad of importance in the country has set about studying its problems and seeking for a solution. Competent research staffs have been organized to consider the traffic possibilities of each territory and the best means to retain and increase railroad traffic. Laboratory tests are being applied to every new suggestion for improving operating and mechanical methods. The industry is wide awake to its responsibilities and its future.

As an illustration of the interest in research, reference may be made to the work of the Railroad Committee for the Study of Transportation, an organization set up by the Association of American Railroads. Soon after its creation more than a year ago, this committee organized some fifteen sub-committees, each charged with the duty of making a special study of some one phase of railroading. Sub-committees were also created to examine every possible aspect of competitive transport. As an example of something already definitely accomplished, the Sub-committee on Engineering and Mechanical Research has recommended to the board of directors of the association the creation of a technical research staff under the supervision of a competent director. It is expected that this new department will devote its energies to basic research in railroad engineering.

OF course, there is necessarily a large measure of uncertainty regarding the future, depending, as it must, upon the duration of the struggle and the conditions of peace. But upon the premise that our free enterprise system will continue, we should be able to plot the course of events with some degree of confidence.

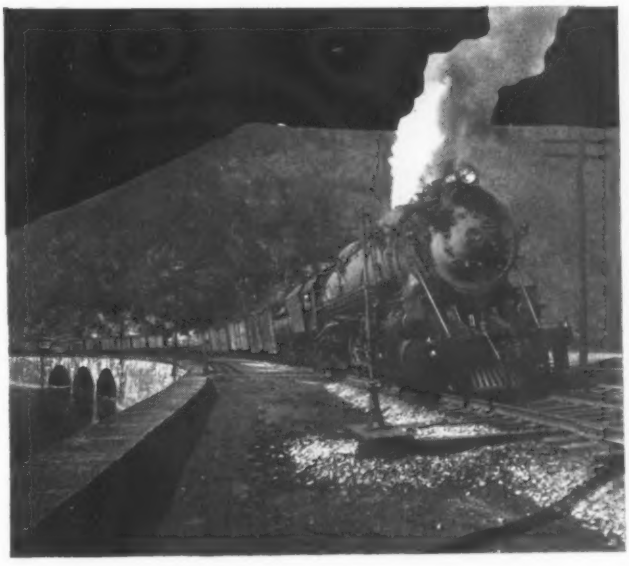


Photo Conner-Geddes

By GEORGE A. BRYANT
President, The Austin Company

THE outlook in the construction industry, particularly in the field of industrial plants and commercial buildings, is very favorable. Present indications point to even greater activity in this field than the average before the war.

It might be assumed that, because of the many plants constructed during the war, industry would be well supplied with manufacturing facilities of all types. However, a great many of the war plants are too large and unsuitable for the manufacture of consumer goods or other products for which there is a growing, unfilled demand. What is more important, a great many of them are not located where the industries now most in need of new or larger plants could make use of them.

Briefly, the factors that are stimulating industrial construction are as follows:

1. Few manufacturers have been able to expand or modernize their plants during the war period. Many established firms are becoming increasingly aware of the high costs and inefficiencies of operating in multi-story buildings, and are awaiting their first opportunity for removal to one-story buildings. In many instances, they are considering outlying sites. There is also a heavy backlog of demand for construction in many distribution and service industries, which have been unable to keep up with changing habits and shifting population trends.

2. The development of new manufacturing processes, many of which can best be served by plants of special character designed closely around the process, represents one distinct group of prospects. Included in this group are a number of new industries, some in the food and chemical fields, and others in the metals field.

3. Relocation is being considered by many industries as a means of cutting production costs, reducing distribution expense, and rendering more effective service to customers. The construction of plants at more advantageous sites is viewed by many as one of the most effective means of meeting competition. Firms that have prospered and grown to national importance in plants located where their founders set up shop anywhere from twenty-five to one hundred years ago are re-examining the economics of such locations in the face of growing competition and declining profit margins.

4. Decentralization of manufacturing operations is under way in many industries, for the same reasons that relocation is being considered. This is particularly true in consumer goods, automotive equipment, and other industries serving stable, national markets. It has long been the policy of container manufacturers, for instance, to locate small plants as close as possible to the industries

that use their bulky products. While there are few exact parallels for this relationship between container manufacturers and canners or packers, the same principles apply in many industries.

5. The revamping of plants for more efficient operation and the conversion of many factories from special war production to peacetime operations will account for a large volume of construction activity. While certain of our war plants have been designed for special or single-purpose operations that have no exact parallel in normal times, the greatest part of America's war plant investment is in structures possessing basic flexibility, which renders them potentially useful for many types of manufacturing activity. The ultimate value of these buildings to industry hinges on the ability of engineers to adapt them for economic post-war uses.

THE serious attention that industrial executives are giving to the basic economics affecting all their operations is the best indicator of things to come. Wartime experiences have opened their eyes to many inefficiencies. Nettled by their inability to match the performance of competitors on certain war contracts, some have discovered that they were over-departmentalized and are planning to improve their methods in new plants as soon as war restrictions are lifted.

For one organization which is contemplating extensive post-war expansion in various parts of the country, we have recently surveyed conditions in more than two hundred towns, distributed in half a dozen states, to find a single location. The approximate location of the prospective plant was determined by the markets to be served, but the final selection of a site rested on basic population characteristics, and on taxes, water supply, power, transportation, etc.

It should be said that industry's viewpoint toward the character of its future plants is marked by the same thoroughgoing engineering approach exemplified in this search for a suitable location. Where new plants are needed, management will not be satisfied with buildings that do not offer the basic facilities for efficient production and a contented body of employes. Wartime experience has proved that man-power shortages and labor difficulties can be minimized by the right kind of working conditions.

The use of color in connection with safety, lighting, and for purely psychological reasons has received increasing attention. With industrial and office workers growing more and more conscious of the use of color in their homes and in all sorts of commercial establishments, it is only natural that color should be given consideration in the surroundings where the greatest proportion of their waking time is spent.

THE availability of more economical air-conditioning, modern fluorescent lighting, and efficient insulation have a direct bearing on the outlook for future construction of windowless, controlled-condition plants, which have demonstrated their efficiency during the war period. Such plants, with twenty-four hour control of lighting and year-round atmospheric control, have made it possible for many industries to coordinate varied processes in straight-line operations, with improvements in quality, efficiency, and employe relations.

As electronic devices and other mechanical developments render production and control equipment more efficient, the cost of air-conditioning will be progressively reduced and the value of controlled-condition plants increased.

POST-WAR industrial plants will utilize many new materials, some of which were barely developed before wartime restrictions put them on the shelf. New concrete and masonry techniques developed in the effort to conserve materials have made

a permanent place for themselves in the industrial building field. Many other new materials and advanced types of building equipment, already perfected, have been held up by industry's preoccupation with war activities, and will make their first appearance in these new plants.

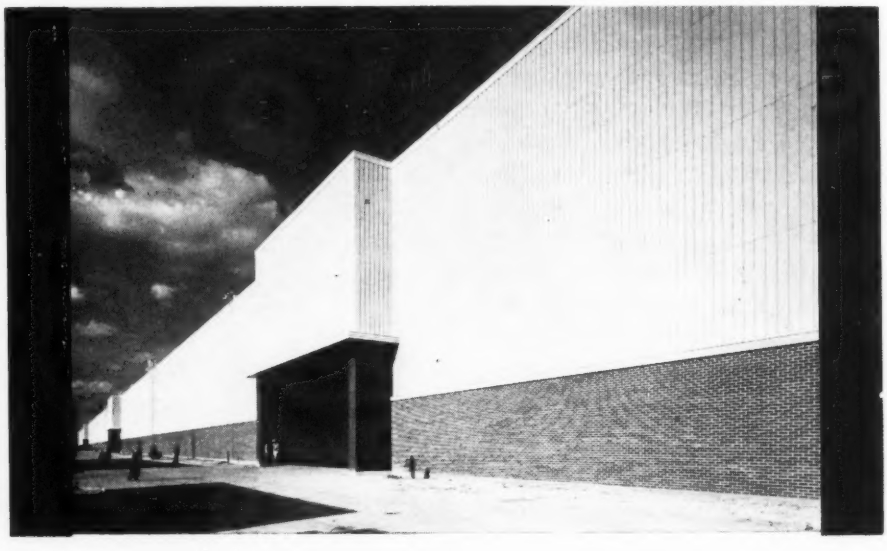
In this connection, it is to be hoped that cities which are still hampered by outmoded building codes will revise them promptly, so that their industries and home owners may realize all the economies and benefits of modern construction. While certain more progressive cities have already overhauled their codes, a great number are still laboring under regulations that perpetuate inefficiencies for the benefit of particular groups.

Quite apart from the bearing of such codes on industrial buildings, there is no reason why the cost of homes should be increased merely because material interests or trade groups have persuaded their city councilmen and building commissioners that such things as welding or prefabricated building materials are "unsafe." The function of building codes is to protect the public through measures that insure sanitation and safe construction, and it is as much their province to recognize the safety of new and proved building materials and techniques as to prevent the construction of fire traps.

THE end of the war and the lifting of wartime restrictions on construction will automatically release a substantial volume of engineering and construction for the purposes already indicated. The continuance of that business and the volume it attains will depend, however, on the speed with which industry and business are released from restrictive regulations and taxation which leave no incentive for capital investment.

OBVIOUSLY all the war restrictions cannot be removed at once, but it is never too soon to plan for their removal. The Government, with the advice and counsel of industrial leaders, could well afford to start now on a survey of these regulations, with a view to modifying or removing them, one by one, as conditions permit.

If such steps are delayed until the war is over, the whole tide of post-war industrial developments, much of which starts with construction, will be held back; and if this occurs, prolonged unemployment will confront many who would otherwise find work. For countless enterprises are ready to go ahead as soon as business is confident that Government will respect and encourage the development of industry under the free enterprise system which has been the basis of America's prosperity and growth.



Second War Congress of American Industry

Robert M. Gaylord, Newly Elected President of the National Association of Manufacturers

THE annual meeting of the National Association of Manufacturers, held in New York City December 8 to 10, designated the "Second War Congress of American Industry," was dedicated to production for victory and planning for post-war jobs. The meeting was attended by a representative group of industrial leaders, as well as by high ranking officers in the armed forces.

The various sessions dealt specifically with production and man-power problems. Much attention was given to post-war planning, with special emphasis on the necessity for free enterprise and the encouragement of individual initiative in the reconversion period and in the post-war era.

An outstanding address was made by the outgoing president of the Association, Frederick C. Crawford, president of Thompson Products, Inc., who spoke on "A Better America through Freedom of Enterprise." Mr. Crawford summarized the five most important objectives of post-war America as follows: (1) The highest attainable standard of living; (2) the fullest degree of economic security; (3) the maximum opportunity for productive and remunerative employment; (4) the most impartial economic justice; (5) the greatest degree of personal freedom.

Some of the points made by Mr. Crawford in his address were as follows: "We are the managers of production. Jobs in a better America require a full measure of production. Today, the American people are looking to business management for leadership. No longer will criticism do. No longer can we be negative. Today, we must have a positive plan and act, under a banner, to lead the American people.

"The better America must belong to all of us, not to any class or group or segment of our society. The American people distrust all pressure groups. A program for a better America must benefit all. Through our war production, the American people have developed a profound respect for the leadership of American industrial management. Today, there comes to management the greatest opportunity and responsibility that has come in many years with this returning confidence in its leadership.

"War made us realistic. It ended the stupid idea that we were suffering from a depression of abundance, when we didn't have enough. We found our skins were in danger. Theories would no longer protect us. We must have production. Goods and weapons were needed, not experiments. We stopped talking; we went back to work. Based on this great achievement, we have surpassed the production of all the rest of the world, and victory is assured.

"In this crisis, American industrial management generated the leadership necessary to carry us forward under a free enterprise system. Today, we look ahead to the post-war period. To many, it is a curious thing that in spite of this remarkable record of leadership and output in industry, we find that people fear the future. They have an uncertain fear of unemployment. There is much talk today of post-war jobs, much fear of loss of freedom.

"The planners have asked us to drop Freedom of Opportunity in the material world and substitute two negative freedoms—Freedom from Fear and Freedom from Want. The very expressions imply statism—that the state will do something for us, organize our lives.

"All Americans long for a better America. Today, through the sacrifice of war, they hope to build an America of opportunity, jobs, and security. This better America must belong to all of us—not to any class or group or segment of our society. A program for a better America must benefit all."

Robert M. Gaylord, president of the Ingersoll Milling Machine Co., Rockford, Ill., was elected president of the Association to succeed Mr. Crawford. Mr. Gaylord took office January 1, at which time Mr. Crawford became chairman of the board of directors of the Association.

Editorial Comment

An important aspect of the industrial prospects of this country after the war is brought out in several of the articles on post-war planning published in this number of MACHINERY. It appears to be generally agreed among industrial leaders who have been responsible for our advance in the past that, if individual enterprise is given reasonable freedom when the war restrictions are lifted, there will be tremendous opportunities ahead for industrial activity.

So many of the consumer channels have been dammed up during the war that there is certain to be a tremendous demand for products that have been unobtainable during the war years. It is hardly necessary to mention such things as automobiles and tires; household equipment—refrigerators; vacuum cleaners, kitchen ranges, and electrical home appliances; furniture and house furnishings of all kinds; plumbing supplies and hardware for home building, etc. There is no doubt but that the American consuming public will be eager to have a chance to buy the peacetime products of industry.

Industrial Outlook when Plants Return to Peace Production

The thought, however, that is uppermost in the minds of those who will direct this production is the question, "What are likely to be the philosophy and objectives of the Government with regard to free industrial enterprise?" Will we have a Government in Washington that will encourage initiative, enterprise, and ability in directing industrial operations, or will we have to deal with a government philosophy that is hostile to the free enterprise system that has made this country what it is? Will labor leaders see that the welfare of labor is tied up with the initiative of the free enterprise system and that a high standard of living can be maintained only by encouraging rather than discouraging individual initiative?

The main problem to be solved when the war is over is to re-establish free enterprise as the basis of our national economy. There are many men in high political office today who would like to see the war controls continued—at least partially—during times of peace, who would like to see industry governed by some form of super-planning from the nation's capital, and who would permanently take away from men of enterprise and vision the opportunity to use their abilities in building up the industrial progress and economic welfare of the nation.

This tendency industrial leaders everywhere must combat. To do so requires courage and imagination; but unless a determined stand is taken by those on whom this nation's industrial future depends, there is danger that after we have won the war, we will lose freedom of enterprise, which is one of the freedoms essential to preserve.

The Main Problem is to Re-Establish Free Enterprise

★ ★

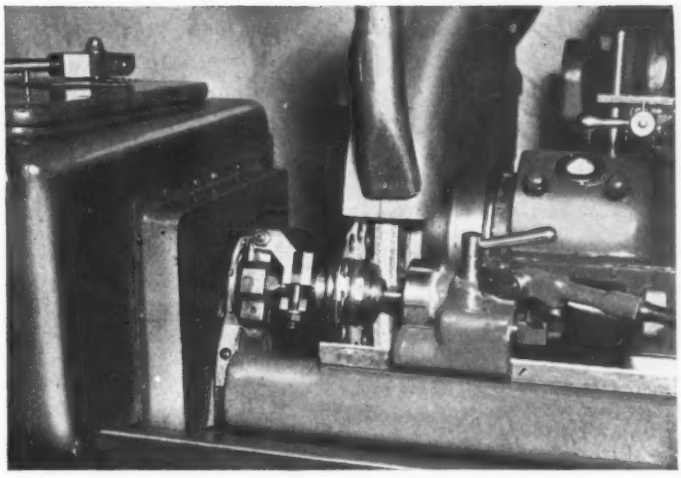
A well-known mechanical engineer, who has designed and developed numerous types of equipment for mass production, recently said that the keynote of machine design for mass production after the war will be to so design the equipment that speed of production will be taken out of the hands of the operator. Unfortunately there is a tendency on the part of many labor leaders to limit production. In times of peace, this tendency is likely to be even more pronounced, and it may be necessary to counteract it by mechanical equipment.

Volume of Production is the Key to Higher Living Standards

In limiting production, labor works against its own best interests. It is obvious that the more that is produced in peacetime for peaceful purposes, the more there is to be divided among all who have helped in the production of these things; and therefore, the more that is produced, the larger is the share of labor. Wages are not paid out of thin air; they can be paid only out of the production of an enterprise. The bigger the production, the larger can the share of labor be; and, in turn, the higher will be the standard of living.

This truth is one that cannot be repeated too often. It must be remembered that a nation cannot have more than it produces.

Unusual Grinding Applications on Small Parts



USING a standard cam-grinding unit on a standard Norton 10-inch Type C hydraulic cylindrical grinding machine, two eight-sided cams are ground from two different diameter rounds. The two rounds from which the cams are ground are located on each side of a disk of relatively large diameter having holes through it, as shown in Fig. 1.

The work is mounted on a dog-driven arbor which, together with the footstock and master cam spindle, oscillates on a bar to and from the wheel under the guidance of the master cam follower-roll. The position of the master cam follower-roll is fixed relative to the base within the case shown at the left in Fig. 1. The wheel and work rotate constantly. The grinding of each round to the shape of an eight-sided cam progresses as the wheel is fed inward.

The cams are ground directly from the round with a stock removal of 0.010 to 0.015 inch to a finish of 10 to 15 micro-inches r.m.s. A production of forty-five parts per hour has been obtained with this arrangement.

In Fig. 1, the left edge of the wheel is shown grinding the right and smaller cam. When this operation is completed, the wheel is shifted to the other side of the pierced disk and the right edge of the wheel grinds the left and larger cam. Variation in cam size and contour is controlled by the shape of the particular master cam utilized. Selection of the master cam is by means of the lever on the top of the case at the left in Fig. 1.

A double-wheel mount is used on the same type of grinding machine (6-inch size) to grind simultaneously the two small diameters on the part shown in Fig. 2. A high-speed live-spindle attachment is employed to rotate the work fast enough (875 R.P.M.) to obtain the desired finish.

With the grinding wheel retracted, the work is loaded between centers. The spring-loaded lever type footstock presses the work against the center and a special driving pin in the high-speed live-spindle attachment. The difference in diameter between the two wheels used is exactly equal

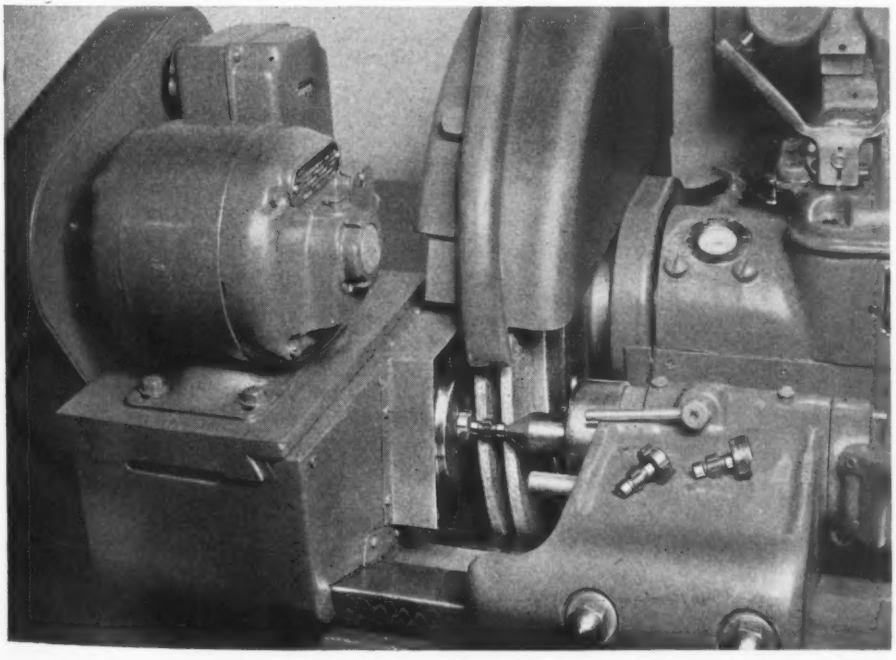


Fig. 1. (Above) Grinding Two Eight-sided Cams of Different Diameters Directly from the Round with One-diameter Wheel in Single Set-up

Fig. 2. (Left) Grinding Two Small Diameters and Adjacent Shoulder with a Double-wheel Mount and a High-speed Live-spindle Attachment

to the difference in diameter between the two parts of the work being ground, the larger wheel grinding the smaller work diameter.

The wheels, mounted on the same spindle, are advanced simultaneously at grinding speed by the movement of the wheel-slide. When this slide comes in contact with a positive stop, the correct work diameter has been reached. Then, by a lateral movement of the wheel-spindle, actuated by a hand-lever and measured by a dial indicator, the outer side of the left wheel faces off the side of the head of the part being ground.

* * *

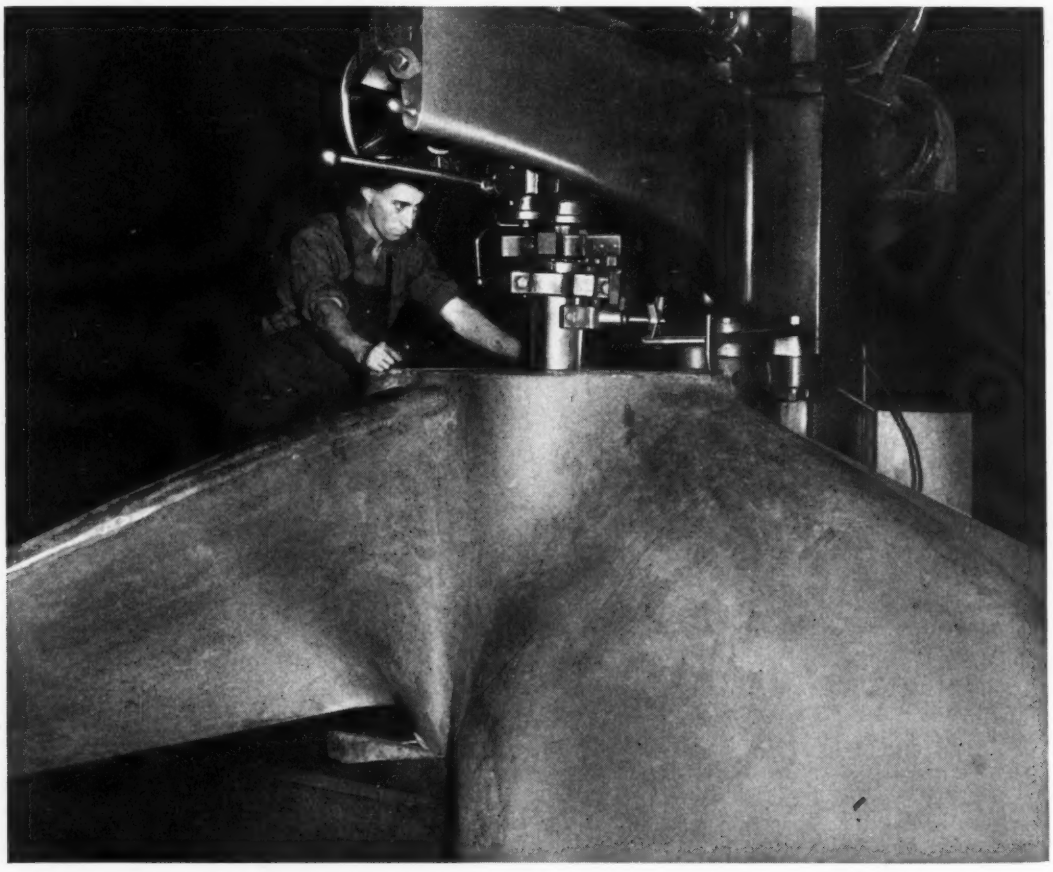
Machine Tool Production

According to information published by the War Production Board, machine tool shipments in October, the last month for which complete statistics are available, total $76,000,000, a decline of about 11 per cent from September. The backlog of unfilled orders for machine tools was valued at approximately $286,000,000 on October 31. The net orders placed in October—that is, new orders less cancellations—amounted to approximately $30,000,000, or at an annual rate of about $360,000,000.

Taper-Boring a Ship's Propeller Under a Radial Drill

Cast-iron spare propellers are bored and faced in the machine shop of the Todd-Bath Shipyard at Portland, Me., under a Western radial drilling machine set up as shown in the illustration. The operation is performed by the use of a wabble-bar, which is mounted off center on a ball-bearing socket beneath the propeller. The arrangement is such as to provide for machining the bore to a taper of 3/4 inch to the foot. The cutter-head is fed gradually down along the bar by means of a lead-screw which is given a partial revolution with each complete revolution of the boring-bar. The feed movement occurs each time that a star-wheel mounted near the top of the boring-bar comes in contact with a stationary rod which extends forward from the column of the machine.

In this operation, the propeller is bored to a maximum diameter at the bottom of 15 1/2 inches, the length of the hub being approximately 3 feet. Then the upper side of the propeller is counterbored to a diameter of 17 inches. The propeller has a weight of about 14 3/4 tons. It is conveniently transferred about the shop by means of overhead traveling cranes.



Taper-boring a Large Spare Propeller on a Radial Drilling Machine Equipped with a Wabble Type Boring-bar

Maintaining Quality Control of Machined Parts

By A. L. ATHERTON, Manager Quality Control
and LOUIS C. YOUNG, Statistician
Westinghouse Electric & Mfg. Co.

How a System of Statistical Quality Control is Being Used Successfully in Connection with the Inspection of Machined Parts at the Westinghouse East Springfield, Mass., Plant

FROM a quality standpoint alone, the ideal objective of any manufacturing process would be to have every piece passing through the process come up to the required standard. In the metal-working industry, this objective may be occasionally obtained where tolerances are relatively large. But for the more exacting work, even where a great deal of care, skill, and the aid of precision machinery is employed, this is, for the most part, neither feasible nor economical.

Some provision must be made, therefore, to detect and segregate those parts that do not measure up to the standards established. This usually takes the form of a preliminary gaging by the workman and a final gaging by an inspector. In wartime especially, the gaging by an inspector provides a very necessary safeguard to prevent defective products from being sent out from the factory. Such inspection also serves the purpose of calling attention to the development of unsatisfactory conditions in the process of manufacture, as evidenced by any unusual increase in the number of rejected parts.

Although it may perform these functions satisfactorily, the ordinary system of inspection does not provide any basis for determining whether or not the ratio of rejections to a given number of pieces produced, which is established as permissible, is at as low a level as possible.

The addition of "quality control," utilizing a simple statistical technique to obtain and plot in chart form the data acquired by inspection, does provide a means for keeping the variation in quality of the product within the narrowest possible limits and the ratio of rejections to a given number of pieces produced at the lowest possible level, consistent with economical inspection.

As set forth in American War Standard Z 1.1-1941, published by the American Standards Association, when statistical quality control is established, the following advantages are provided:

(a) The variation between individual units will be a minimum for the production process in use.

(b) Data from samples of the product have the greatest possible reliability as a basis for judging its quality. Sampling and testing, and hence the cost of inspection, can be reduced to a minimum. As a result, it often follows that sampling inspection is adequate, both for the manufacturer and the purchaser. The reliability of sampling results is particularly important when assurance regarding the quality of an entire quantity of similar articles or material must be based on the inspection of only a limited number of articles or test specimens. This will be the situation when 100 per cent inspection

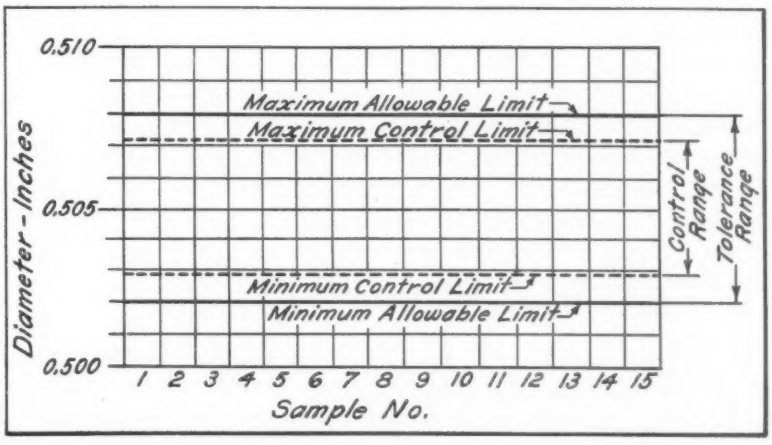


Fig. 1. Blank Chart for Plotting Quality Control Data, Showing Location of Control Limits within the Allowable Limits. The Allowable Limits are Usually Not Drawn in on the Quality Control Chart

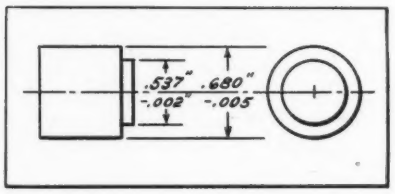


Fig. 2. Simple Machine Part Used as Basis for Discussion of Typical Control Methods for Two Dimensions Indicated on Drawing

is impracticable or impossible, as happens when the inspection test of an article is destructive or when tests are made to measure the physical or chemical properties of materials, bulk products, or the like.

(c) The percentage of product whose quality will lie within any pair of limits may be predicted with the highest degree of assurance.

(d) There is a reliable basis for determining whether there would be a practical advantage in changing the specification limits. This question is important, for example, when the manufacturer has to choose between the use of ample specification limits combined with selective matching of components and the use of closer specification limits that permit interchangeability of components.

(e) Acceptance of a product by the purchaser may often safely be based on the manufacturer's evidence of control rather than on results of the purchaser's own sampling, shipment by shipment. This may be accomplished if continuing control chart records are, by agreement, made available by the manufacturer to the purchaser, who will then need to test only occasional samples as checks on the quality records furnished by the manufacturer.

As applied to machine parts, this method of control consists essentially in taking measurements of a given number of pieces for the dimension under inspection, plotting these measurements in chart form, and noting or computing the relationship of these data to each other.

In the Westinghouse East Springfield plant, the products in a sample group are measured. These measurements, together with their average, are plotted on one chart, and the range, or difference between the highest and lowest measurement in the group, is plotted on another chart. After a certain interval of time, samples taken from another group are measured and similar data are plotted.

The control chart on which these measurement values are plotted is set up with a pair of lines representing two dimensions, known as *control limits*. As shown in Fig. 1, these control limits lie within the tolerance range, that is, the upper is less than the maximum allowable limit and the lower is greater than the minimum allowable limit for the dimension under inspection. These control limits are so established that the plotted data indicate when a variation of the dimension under inspection is the probable result of a dis-

Table 1. Measurements of the 0.680-Inch Diameter on Seventy-Two Pieces Machined in a Conomatic, Made to Determine Normal Variability

Cycle Number	Spindle Number					
	1	2	3	4	5	6
1	0.6768	0.6465	0.6757	0.6775	0.6779	0.6777
2	0.6760	0.6777	0.6771	0.6787	0.6764	0.6763
3	0.6766	0.6782	0.6784	0.6775	0.6779	0.6772
4	0.6765	0.6768	0.6772	0.6776	0.6779	0.6778
5	0.6773	0.6771	0.6776	0.6772	0.6775	0.6773
6	0.6774	0.6773	0.6780	0.6781	0.6783	0.6770
7	0.6756	0.6775	0.6768	0.6781	0.6770	0.6767
8	0.6765	0.6764	0.6785	0.6770	0.6777	0.6768
9	0.6789	0.6792	0.6768	0.6780	0.6755	0.6772
10	0.6762	0.6784	0.6789	0.6765	0.6766	0.6777
11	0.6785	0.6770	0.6780	0.6772	0.6779	0.6759
12	0.6780	0.6774	0.6771	0.6765	0.6767	0.6785

Table 2. Data Used in Determining Index of Variability for a Particular Part

D represents the difference, in 0.0001 inch, between each measurement and the measurement of the next part made on the same spindle, and *S* represents the square of this difference.

D	S	D	S	D	S	D	S	D	S	D	S
8	64	12	144	14	196	12	144	15	225	14	196
6	36	5	25	13	169	12	144	15	225	9	81
1	1	14	196	12	144	1	1	0	0	6	36
8	64	3	9	4	16	4	16	4	16	5	25
1	1	2	4	4	16	9	81	8	64	3	9
18	324	2	4	12	144	0	0	13	169	3	9
9	81	11	121	17	289	11	121	7	49	1	1
24	576	28	784	17	289	10	100	22	484	4	16
27	729	8	64	21	441	15	225	11	121	5	25
23	529	14	196	9	81	7	49	13	169	18	324
5	25	4	16	9	81	7	49	12	144	26	676

The method of computing the index of variability is as follows:

Total of squares of differences = 9853

Number of differences = 66

$$\text{Index of variability} = \sqrt{\frac{\text{Total squares of differences}}{\text{Twice the number of differences}}} = \sqrt{\frac{9853}{2 \times 66}}$$

= 8.6 "tenths," or 0.00086 inch

turbance in the production process, which should be investigated and identified.

Such a variation indicates the presence of an *assignable cause* (cause of trouble). There are other variations in the data, of course, that are of no particular significance as far as the process is concerned, and merit no investigation.

As pointed out in American War Standard Z 1.1: "When the assignable causes have been eliminated from the production process to the extent that practically all the points plotted on the control chart remain within the control limits, the process is said to be in a state of *statistical control* with respect to the measure of quality under consideration. When a state of statistical control is reached, no higher degree of uniformity in quality can be attained with the production process in use. It may thus be concluded that greater uniformity can then be attained only through a basic change in the process itself.

"When the quality is controlled and the level of control is found to be such that the product does not meet the specification limits in a satisfactory manner, either of two corrective measures may be taken: (a) Shift the level of control by making basic changes in the production process or (b) adjust the specification limits to the existing level of control."

The process followed at the East Springfield plant will be outlined in detail. The machined part to be considered is made of brass bar stock, and has the dimensional requirements shown in Fig. 2. The manufacture of this part is carried out in two steps: First, the part is machined on a six-spindle Conomatic screw machine, leaving a few thousandths of an inch to spare on the 0.537-inch diameter. Second, the 0.537-inch diameter is machined to size on a hand screw machine. The production of this part is continuous.

The methods used to control these two dimensions are very much alike; the only difference lies in the basis of the sampling. It will be advantageous, therefore, to describe the method of controlling one of these dimensions, and then point out the difference between them. The 0.680-inch diameter will be selected as an example.

About once every four weeks, a sample of sixty or more pieces is taken, one after another, from the Conomatic machine. These are placed on racks in the order of manufacture, and each important dimension is measured and recorded. The record of these measurements for the 0.680-inch diameter on seventy-two pieces is given in Table 1. From these measurements, it is possible to obtain some idea of the normal amount of variability to be expected in this dimension.

An index of the variability (called the *standard deviation)* is obtained as follows: The difference in diameter between each part and the part next produced on the same spindle is recorded and squared. The squares of these differences are then added together and their total is divided by twice the number of differences taken. The square root of the result represents the index of variability for the data under consideration. (An index computed on this basis tends to give greater weight to the larger variations than would a simple average of the differences.)

These computations are carried out by an inspector following a standard example, and are shown for this particular example in Table 2. The resultant index of variability of the machining process is used later in determining control limits for periodic samples. This is shown in Table 3, and will be discussed subsequently.

During everyday production of the parts, a sample of six parts is taken periodically, one

Table 3. Factors for Determining the Control Limits for Average Measurement and a Range of Measurements in a Sample

Number of Parts in Sample	Factor for Limits on Average Measurement*	Factor for Limit on Range of Measurements*
4	1.160	4.70
5	1.038	4.92
6	0.948	5.08
7	0.878	5.20
8	0.821	5.31
9	0.774	5.39
10	0.734	5.47
11	0.700	5.53
12	0.670	5.59

To determine the limits for the average measurement, multiply the factor shown in the second column corresponding to the number of parts regularly taken as a sample by the index of variability for the dimension being considered. Subtract this product from the upper tolerance limit to obtain the upper control limit for averages. Add the product to the lower tolerance limit to obtain the lower control limit for averages.

To determine the limit for range of measurements in a sample, multiply the factor shown in the third column corresponding to the number of parts regularly taken as a sample by the index of variability for the dimension being considered.

Example—For the 0.680-inch diameter on Part No. 73-8-81 B, the latest index of variability is 0.00086 inch, the allowable limits are 0.680 inch and 0.675 inch, and the number of parts periodically collected as a sample is six.

The upper limit for the average measurement in this case will be:

$$0.680 - 0.00086 \times 0.948 = 0.6792 \text{ inch}$$

The lower limit will be:

$$0.675 + 0.00086 \times 0.948 = 0.6758 \text{ inch}$$

The limit of the range of measurements will be:

$$5.08 \times 0.00086 = 0.0044 \text{ inch}$$

*These values have been calculated by means of statistical formulas, and are adapted to the type of operations referred to in this article.

from each spindle of the machine. This sample is taken to an inspection room, where each "controlled" dimension is measured and plotted on a control chart. Fig. 3 shows the plotted data for the 0.680-inch diameter. The average of the measurements of each controlled dimension in the sample is computed and plotted as a circled dot in the same column as the measurements. At the same time, the smallest measurement of each controlled dimension in the sample is subtracted from the largest and this difference is plotted on a separate chart below, but in the same column as the measurements and their average. This chart is shown in the lower portion of Fig. 3.

As long as the machining process is running satisfactorily, with the usual degree of variability in the measurements under consideration and with the average of these measurements lying about midway between the allowable limits, there is little chance that unacceptable parts will be turned out between samples and escape notice.

Whenever the average measurement of the sample falls near one of the allowable limits, however, there is reason to believe that some of the parts made since the previous sample was tested are actually outside the tolerance range. The same holds true if the range of the sample measurements suddenly increases to an abnormal value.

How close to either allowable limit we can safely permit the average measurement to fall before shutting down the machine to make adjustments in the production process clearly depends on the risk we are willing to take of making some bad parts. The greater the permissible risk, the closer we can let the average approach the allowable limit without changing the set-up. The ordinary degree of variability to be expected in the machining process is also a determining factor; the less the variability, the closer we can safely permit the average measurement to approach either allowable limit.

The number of parts composing the sample is another governing factor, since the average of a large number of parts is usually less variable than that of a small number. Therefore, disregarding other factors, the larger the sample, the closer the average measurement can be permitted to approach either allowable limit.

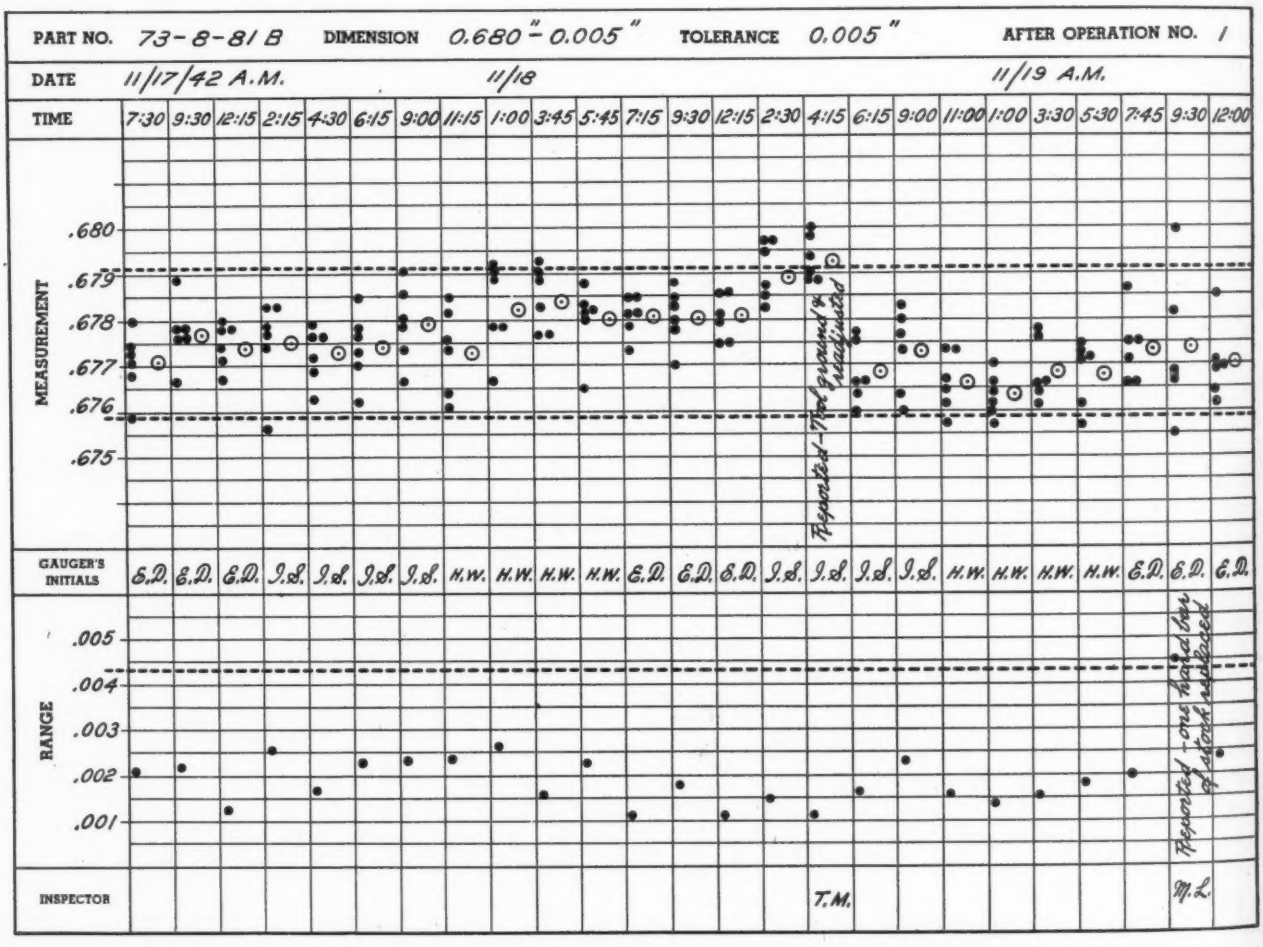


Fig. 3. Control Chart Showing in Upper Section the Plotted Sample Data (Solid Dots) and Their Averages (Circled Dots), and in the Lower Section the Range (Difference between Highest and Lowest Value) of Each Sample

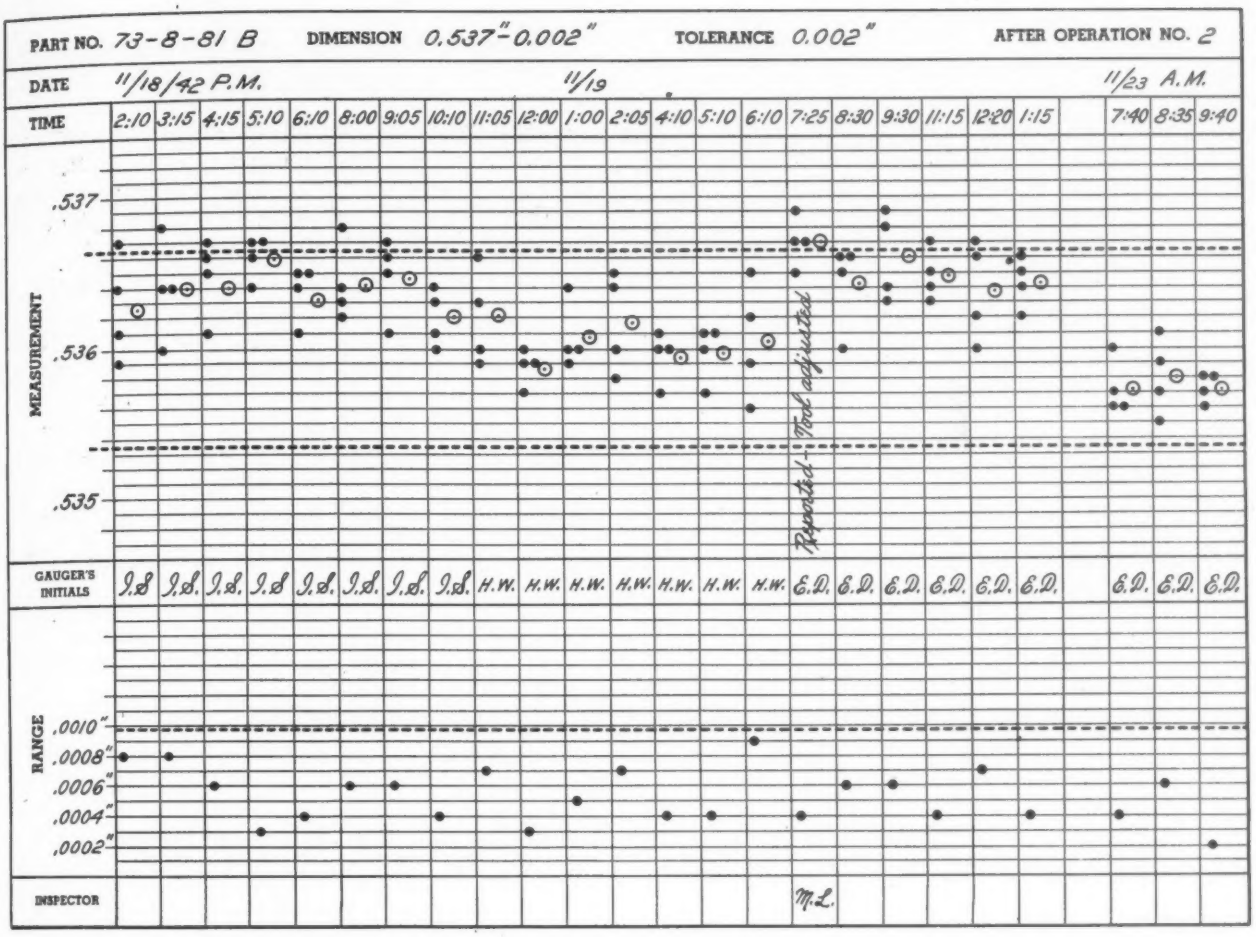


Fig. 4. Another Quality Control Chart, Showing Use of Smaller Samples Taken More Frequently

Taking these factors into consideration, a set of control limits for the average measurement of the sample is computed and drawn on the chart. The computation of the location of the control limits is performed by an inspector, using the index of variability previously obtained and a set of standard factors, as shown in Table 3.

Now let us consider again the range, or difference between highest and lowest measurements, of any given sample. Under ordinary conditions of operation, the average range of sample measurements will bear a definite relationship to the index of variability previously discussed. Many abnormal conditions of operation, caused by some change in the machining set-up, will show up as an unduly large range in the sample measurements. A control limit that the range of a sample should seldom exceed under satisfactory operating conditions is computed in the manner shown in Table 3, and plotted on the lower control chart shown in Fig. 3.

When the measurements of each periodic sample of parts are made and recorded on the control chart, along with the average measurement and range, the quality control inspector notes whether these two characteristics lie within their respective limits. If they do not, the floor inspector is notified as to which dimension runs out, and he, in turn, notifies the operator of the machine. At the same time, the floor inspector sets aside all parts that have been made since the previous sample was taken for detailed inspection of that particular dimension.

On the other hand, if all charts pertaining to the part in question indicate that all important dimensions are satisfactory, all of the pieces turned out since the previous sample are considered acceptable. When an accumulation of these acceptable parts has been made, the entire lot is subjected to a spot check, covering uncharted dimensions and other more general characteristics.

The difference between the two types of opertions, exemplified by the 0.680-inch and the 0.537-inch diameters, lies in the number of parts taken for a sample and the number turned out between samples. In the case of parts made on a multi-spindle automatic screw machine, the sample consists of one part from each spindle. If the part is turned out on a single-spindle machine, the sample may consist of as many parts as may be considered advisable, but at least four are taken. Similarly, sample parts

are collected more frequently from machining operations that are more dependent on the skill of the operator.

The benefits of the quality control procedure as followed in the East Springfield plant may be summarized as follows:

1. The operation of graphically recording each measurement provides a visual picture of the size of the parts being made and their location relative to the tolerance limits.

2. The record of the average measurement of each sample presents a readily understood picture of any trend that may be present.

3. Definite responsibility is placed upon the quality control inspector and the floor inspector, respectively, for recognizing that corrective action needs to be taken, and for taking it.

4. Restriction of machine operation, that is, machine shut-down due to the production of rejected parts, is kept to the minimum necessary to produce acceptable parts.

5. Standardization of procedure reduces the possibility of lapses in quality due to indifference, partiality, rush demand, and other factors.

6. Because the system is based upon recognized tolerances and upon the tested variability in the process, it has a common-sense viewpoint which meets with little rational resistance.

7. The allocation of different types and degrees of responsibility to different individuals results in greater efficiency. Floor inspectors are relieved of a great deal of routine inspection, and consequently can cover many more machining operations.

8. The amount of detail inspection is reduced, because the production of unacceptable parts can often be foreseen and prevented. Thus, for example, when the successive sample averages, as plotted on the chart, show a trend that approaches either of the allowable limits, trouble can be anticipated before it occurs, that is, before the measurements begin to exceed the allowable limit.

* * *

Cast Meehanite Tool Shanks and Milling Cutter Bodies

The vastly increased production of cast Meehanite tool shanks, forming-tool holders, and milling cutter bodies at the plants of the Cooper-Bessemer Corporation has reached a volume sufficient to release at least 850 tons of steel for producing other vital war material. The inability to obtain forged tool shanks and cutter bodies led the company to utilize its facilities in developing and producing cast tool shanks and cutter bodies from Meehanite. This departure has proved entirely satisfactory.

Pentrating—A Salt Mixture Oxidation Process

A salt mixture oxidation process known as "Pentrating" is being applied to ferrous metals, such as small aircraft engine parts, at the Republic Aircraft Products Division plant of the Aviation Corporation, Detroit, Mich. The lustrous black finish that results from the application of this process is said to have marked anti-friction and anti-rust qualities. The process is not a deep impregnation, but simply a coating of oxide film. No change takes place in the dimensions of the parts treated.

The line for applying the "Pentrating" process consists of six tanks. The first step in the treatment is the immersion of the parts in a mixture of alkali cleaner and water at a temperature of 180 degrees F. Immersion for from fifteen to twenty-five minutes in this solution removes all oil and grease. Tank No. 2 contains a hot water rinse in which the parts, placed on racks, are dipped twice by hand to wash away all traces of the alkali cleaner solution.

The third tank in the line contains the "Pentrate" solution, heated to a temperature of from 285 to 290 degrees F. The parts are held in this solution for about twenty-five minutes. They are then transferred to tank 4, which contains a second batch of Pentrate solution at a temperature of from 302 to 304 degrees F. In this tank, too, the parts are kept for twenty-five minutes.

The fifth tank contains a cold water rinse in which the parts are kept another twenty-five minutes, the water being agitated by air to remove all traces of free Pentrate deposit. The sixth tank contains a mixture of soluble oil and hot water at a temperature of 180 degrees F. A final twenty-five minute immersion in this mixture provides an oil coating for the surface of the Pentrated part. When removed from this tank, the treated pieces are hung on racks to drain and to cool before being placed in the stock trays. After a final degreasing, they are treated with a rust preventive solution and wrapped in waxed paper for shipment.

Owing to the low temperatures at which this treatment is applied, there is no distortion of the parts being treated. A control panel maintains the treatment temperatures automatically. The solution is never changed, but is merely added to, compensating for the loss due to transferring parts from one tank to the next.

* * *

Air depots in this country and abroad are using Tenite plastic pellets in sand-blasting equipment to remove carbon from piston walls and from the narrow piston-ring grooves.

How to Secure Fine Surfaces by Grinding

By the Late H. J. WILLS
and H. J. INGRAM, Engineer
The Carborundum Co., Niagara Falls, N. Y.

Eighth of a Series of Articles Describing the Factors that Govern Fine Surface Quality and the Means by which This Quality Can be Obtained—The Present Article Deals with the Balancing of Grinding Wheels

IN the two preceding articles, special consideration was given to the development of correct methods and equipment for truing and dressing grinding wheels for different types of work. The present article deals primarily with the important subject of balancing grinding wheels.

Conditions Responsible for Chatter Marks

There are at least a dozen causes for the appearance of chatter marks on cylindrical work, probably the most common being an out-of-balance condition in the grinding wheel. Each cause has its characteristic symptom which the grinding machine operator should recognize, so that no time will be wasted diagnosing the trouble or in trying to correct a condition that is not the real cause of chatter marks or unsatisfactory finish.

Thus, it is common for inexperienced operators to place the blame first on the spindle bearing. A loose bearing will cause chatter, but to tighten a bearing that is in proper adjustment is nearly certain to damage the machine. It is easy to spot chatter caused by out-of-balance, for the marks are distinctive, being long, regularly spaced, and forming a checker-board pattern. A loose spindle bearing will cause marks that are short and closely and evenly spaced.

The hammering of the wheel on the work—which causes the chatter marks—makes it impossible to do accurate work and secure fine surfaces with an out-of-balance wheel. Also, a wheel that is out-of-balance will wear too rapidly, will cause excessive wear of the truing diamond, and may even damage the diamond tool. For one thing, the hammering action of the wheel on the work causes the wheel face to break down too fast and thus necessitates too frequent truing.

If a wheel is seriously out-of-balance, no amount of truing will give it the true cylindrical form requisite in fine grinding. Furthermore, if the wheel is out-of-balance when it is given its first truing after mounting, it will hammer on the truing tool and very likely break it. It is, therefore, essential—especially with large wheels in which the effect of out-of-balance is exaggerated—to balance the wheel before truing it, and then, because the truing may again throw it out-of-balance, to balance it once more before starting to grind.

The first balancing can sometimes be omitted in the case of small-diameter wheels that are to be used only for commercial grinding, but large wheels and those from which fine results are desired should always be balanced both before and after the first truing. This preliminary balancing establishes a true running condition with minimum of truing and wheel loss. Uniform truing and dressing can be obtained only when the wheel is in balance.

Methods and Equipment Employed to Balance Wheels

Proper balancing is an operation calling for considerable skill. Therefore, the best results will be secured by having all balancing done by one or two men who have been thoroughly trained in the procedure. It can well be done in the tool-room. This will eliminate the delays in production that occur when the balancing is done by the grinding machine operator. It is just as logical to have wheels balanced by a trained man as it is to have cutting tools sharpened by a tool-room man.

Several complicated and highly scientific types of balancing equipment are available for determining the location and magnitude of the out-of-balance. In large production shops where a great many wheels have to be balanced, such equipment may save considerable time, but it is possible to determine the out-of-balance within sufficiently close limits to permit very accurate fine grinding with much simpler equipment.

The devices most commonly used depend upon the fact that if a wheel is mounted and free to turn, the heavy spot that causes the out-of-bal-

ance will turn the wheel until the heavy spot is at the bottom. One device consists simply of parallel ways. This outfit must be set up absolutely level or the wheel will roll, even though it is in balance. For the same reason, the ways must be absolutely parallel to each other.

As dents or dirt on the ways may prevent a badly out-of-balance wheel from rolling, the ways must be kept clean and inspected frequently to make sure that they have not been damaged. Dents are most often caused by tapping the balancing weights to bring them into adjustment. To avoid this, always tap the weights from the bottom, never from the top. Also, unless the plane of the wheel is parallel with the ways, the wheel will run into the ways, and so not be free to move, or the balancing spindle will slip on the ways instead of rolling.

Another satisfactory balancing device is shown in Fig. 1. It consists of two sets of overlapping disks on which the balancing spindle rests. This device need not be perfectly level, but it must be kept clean and the disks lubricated, so that they will turn easily. With either of the two types of balancing devices mentioned, it is essential that no foreign matter adhere to the wheel, for it would tend to turn the wheel and indicate an out-of-balance condition where it does not exist. It could even counterbalance an inherent out-of-balance that should be discovered and corrected.

A new wheel is quite concentric with the arbor hole. If it is found to be slightly out-of-balance, it can often be corrected by taking advantage of the fact that there is a small amount of play between the spindle and the arbor hole. Mark the heavy side of the wheel, and, when mounting, place the heavy side uppermost. This will bring the out-of-balance point closer to the axis of the spindle, and so correct moderate out-of-balance. If the out-of-balance is too great to be corrected by this means, it will have to be compensated for by the use of weights.

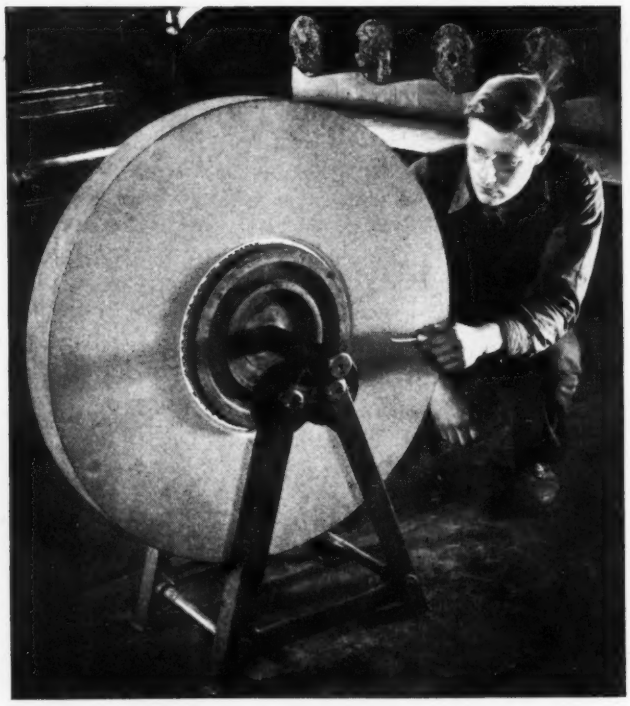


Fig. 1. Overlapping, Revolving Disk Type Balancing Stand Used in Balancing Grinding Wheels

Formerly, it was the custom to dig out a recess in the wheel opposite the heavy side and then try to counterbalance the heavy spot by pouring molten lead in the hole. This was not only slow, but tended to weaken the wheel.

Arbors Equipped with Balancing Weights

Most wheel arbors—especially those for the larger diameter wheels—are equipped with balancing weights, which are mounted in a groove in which they can be readily moved around the axis. There may be two or more of these weights. The method of balancing is essentially the same with any number of weights.

With two weights, proceed as follows: Remove the weights and place the wheel and mount on the balancing device. The wheel will roll or turn until it comes to rest with the heavy spot at the bottom. Mark this heavy point with a chalk mark. Turn the wheel through 90 degrees, first in one direction, then in the other, in order to check the correctness of the first test. If the wheel comes to rest each time with the chalk mark at the bottom, the location of the out-of-balance condition has undoubtedly been correctly determined.

Then draw a chalk line horizontally through the axis on either the wheel or the mount. Insert the two balancing weights just above the horizontal line, as shown in Fig. 2, and again determine the heavy spot as before. If the heavy spot is still in its original position, move both weights farther up from the horizontal line and repeat the test. Continue this procedure until the wheel does not rotate when free to do so.

If, after the first balancing with the weights in position, it is found that the heavy spot is opposite its original position, the out-of-balance condition is very slight and can often be corrected by moving the weights downward to straddle the horizontal line. On the other hand, if the out-of-balance is so serious that even when the weights have been moved up as far as they will go, the heavy spot remains in its original position, it will be necessary to add one or more additional weights, two extra weights being the number usually required.

With four weights, the heavy spot is first determined with the weights removed from the mount. As before, mark the heavy spot and

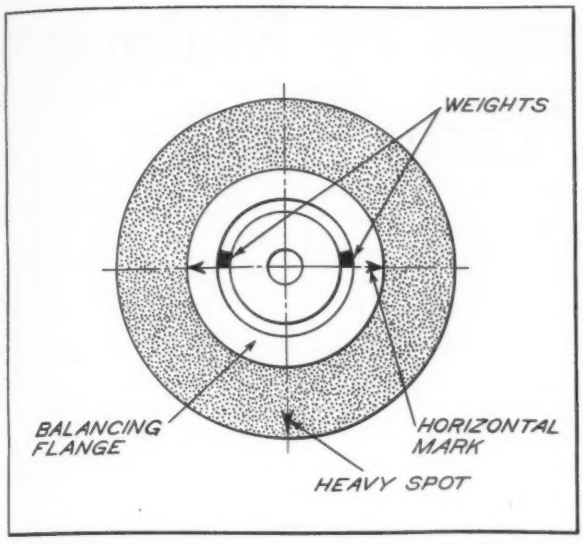


Fig. 2. Diagram Illustrating Method of Balancing Grinding Wheel with Two Weights

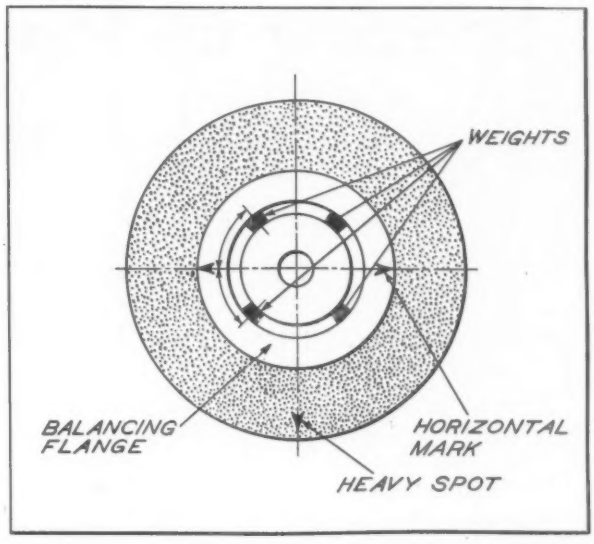


Fig. 3. Diagram Illustrating the Use of Four Weights in Balancing Grinding Wheel

draw the horizontal line. The four weights are then inserted 45 degrees above and below the horizontal line, as shown in Fig. 3, and then the two top ones are raised slightly, which, of course, brings them closer together.

Next, test the wheel; if the out-of-balance is not yet corrected, move the *bottom* weights upward toward the horizontal line. Now turn the wheel through an angle of 90 degrees. If the heavy spot is 90 degrees away from its former position, as it is likely to be, erase the original horizontal line and draw a new one. The weights are then manipulated as before. When, in this way, a wheel has been brought to the point where it no longer turns, it is in such good balance that accurate work of fine finish can be secured with it.

As the wheel loses diameter through wear and dressing or truing—especially if it is a wheel of large diameter—it will probably sooner or later get out of balance again. Although modern manufacturing methods permit wheels to be made of astonishingly even texture, there are likely to be slight variations in density, which in large heavy wheels may cause the wheel to lose balance as its material is worn away.

For this reason, it is often necessary to balance a wheel several times during its useful life. Don't postpone it in a misguided attempt to save the time required. Watch for chatter marks, or, better yet, for the first indications of machine vibration. If a machine that has been free from vibration starts to vibrate, it is time to test the wheel for balance.

* * *

Renegotiation often is a fine paid by a manufacturer for producing efficiently.

National Association of Cutting Tool Manufacturers

On December 10, a group of 150 representatives of about 100 cutting tool manufacturers met at Detroit and decided to form a national association of cutting tool manufacturers. A temporary board of nine directors was formed, with W. G. Robbins, of the Carboloy Company, Inc., as chairman. The temporary board will formulate by-laws and definite plans of organization, membership qualifications, etc. All producers of cutting tools in the United States are to be given an opportunity to become members of the association. Further information can be obtained by addressing the chairman of the temporary board, W. G. Robbins, Carboloy Company, Inc., 11185 East 8 Mile Road, Detroit 32, Mich.

* * *

Increasing the Service Life of Lathe Beds

In tests made to determine what wear-resisting materials are best adapted for lathe bed and carriage construction, research engineers of the Battelle Memorial Institute found that a combination of hardened steel and alloy cast iron was far more wear resistant than other materials now in general use. A process referred to as "flame refining" was developed for improving the wear resistance of the cast iron. According to the tests, the steel should form the carriage surface, and the cast iron the bed surface. A paper on the subject was read before the recent annual meeting of the American Society of Mechanical Engineers, whose headquarters are at 29 W. 39th St., New York City.

Speeding up Production by Multiple Vertical Turret Lathe Tools

By C. W. HECKERT and R. SANTORO
Schenectady Works, General Electric Co.

THE method originally employed for machining electrical contact rings of different diameters and widths from a solid brass plate approximately 28 inches in diameter and 5/8 inch thick consisted of using single tools for the rough-facing, parting, finish-facing, and burring operations. The total time necessary to complete these operations was 139 minutes. The development and use of multiple tools for this job has reduced the total machining time to 43 minutes. The saving of 96 minutes on this operation made it possible to meet the increased demand for these parts without additional machines or operators.

In the accompanying illustrations, the circular brass plate is shown attached to a steel mounting plate, this assembly being secured to a specially made steel bedplate or adapter, which is initially set true with the table and clamped to it, remaining undisturbed during production. The brass plate from which the individual contact rings or a set of rings is to be parted or machined is fastened to the mounting plate by small machine screws arranged in a series of concentric circles. The body holes for the screws in the mounting plate correspond with a similar series of blind tapped holes in the brass plate. The holding screws are inserted in the plate assembly, which was produced in a previous operation.

The assembly is then lifted to its place, with the screw heads down, in the bedplate adapter. The surface of the brass plate in contact with the steel mounting plate was prepared by rough-facing it with one of the specially developed multiple tools, the use of which necessitates a cross-feeding movement of only 1 1/8 inches, instead of 6 5/8 inches with the old method of using a single tool. This phase of the work, as now done by the six-point multiple tool in the turret of the machine, results in a time saving of 10 minutes per plate.

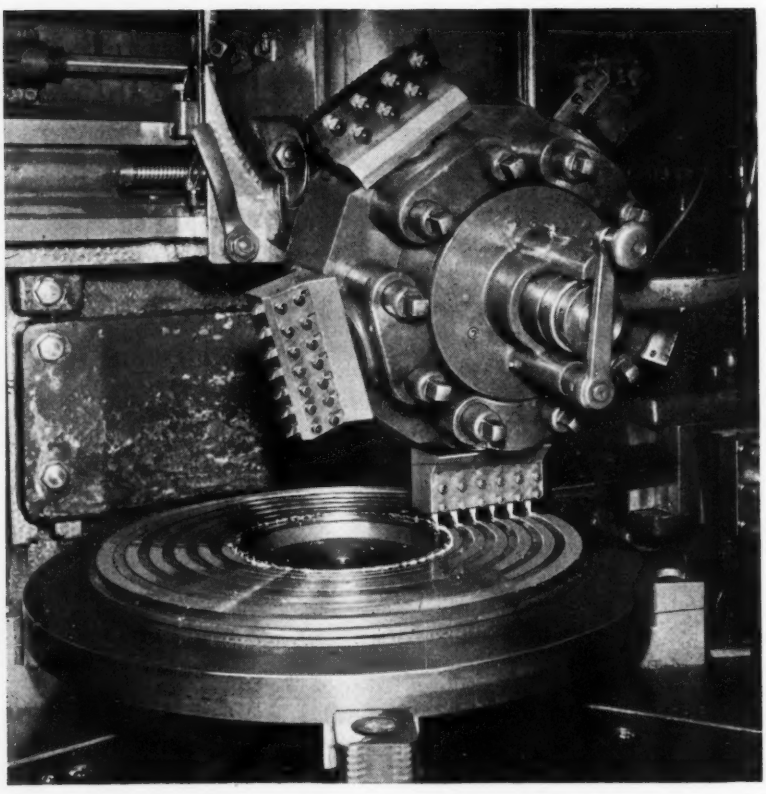


Fig. 1. Multiple Tool Set-up on Vertical Turret Lathe Equipped to Machine Brass Contact Rings

The top or finished surface is next rough-faced in like manner with a similar saving in time. The holding screws are so located that they do not interfere with the parting operation. Thus at the "break through point," the individual rings are still secured to the mounting plate for further operations with other multiple tools.

The turret of the machine is now indexed and a four-point multiple tool for the parting or slotting operation is used to cut twelve of the slots in three moves. The reason for not machining all the slots at once with a multiple tool is that too great a pressure would be exerted upon the holding screws, with risk of damaging the work and injuring the operator. This multiple parting saves 29 minutes. Following this, the two slots still to be cut are completed by the use of a two-point multiple tool, with a time saving of 6 minutes.

The fifteen individual rings parted in this manner must be finish-faced

to size. A seven-point multiple tool in the machine turret is used for this work. It is only necessary to cross-feed this multiple tool 7/8 inch, instead of 6 5/8 inches, as required when a single tool was used. It is during this phase of the machining that 46 minutes time is saved in the manufacture of the contact rings.

Since it is imperative to employ a fine feed to secure the desired finish, the first tool bit of the seven-point multiple tool is positioned at the edge of the smallest ring and the automatic cross-feed lever engaged. Thus, when the first tool bit has passed over this ring and reached the first slot, every preceding tool bit in the holder has similarly faced a single ring or group of three rings and ended in a slot, at which time the multiple tool is quickly raised from the work by the operator.

The final step in the use of these tools is the burring or chamfering operation. This is accomplished by again indexing the turret and using a sixteen-point multiple tool to remove the sharp edges created by the parting and finish-facing operations from the entire set of fifteen contact rings. Here a time saving of 4 minutes is realized.

These multiple tools were built especially for this ring production job. Each tool is so designed that all its tool bits are interchangeable and removable for grinding or replacement.

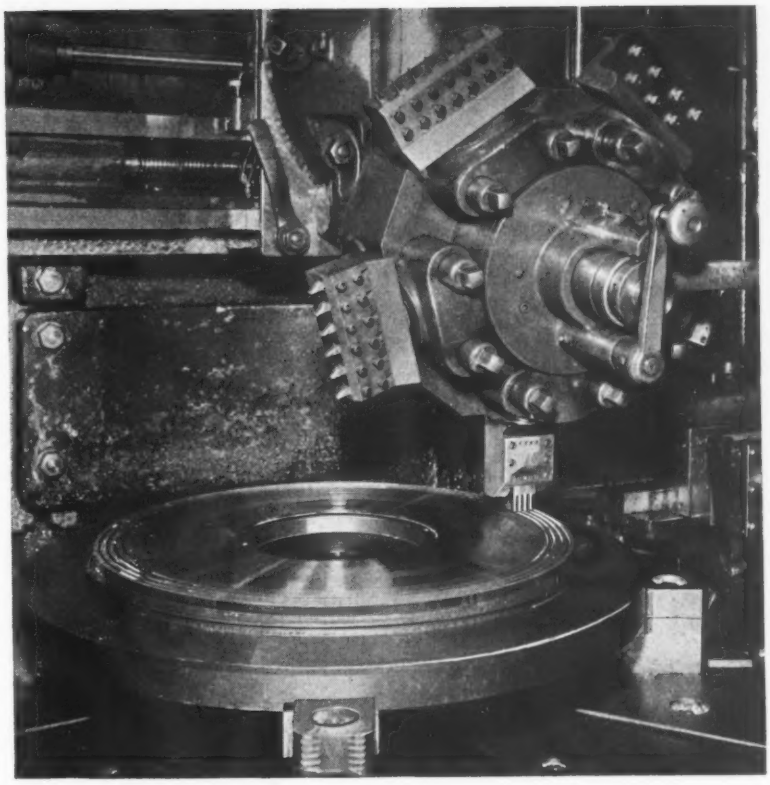


Fig. 2. Vertical Turret Lathe Shown in Fig. 1 with Multiple Parting Tool Cutting Plate into Rings

* * *

Mechanical Light-Shutter Operates Three Times per Second

In military operations, interrupted light beams for transmitting silent messages are being used. Engineers have found it difficult to build a shutter for signaling that is sufficiently light in weight for fast operation and is at the same time durable. Durability in this case means at least two million operations. A new shutter has been developed that operates three times per second and yet possesses the required durability. Made like a venetian blind, the new device uses steel shutters operated by a lever mechanism. According to the Westinghouse Electric & Mfg. Co., this shutter has been operated over two million times; at this point, the test was stopped, since the shutter seemed to continue to operate indefinitely, having shown no measurable wear or deterioration.

New Materials Forge Ahead

In one airplane alone, engineers have substituted plastics and plywood for sixty-six parts formerly made of aluminum alloy. The fabrication of these parts from plastics and plywood has saved approximately 45 per cent of the weight, as compared with the weight when metal was used; in most cases, the cost is also lower. Obviously, plastics cannot be used for extreme temperature ranges, as they cannot stand extremes of temperatures the way metal will. Within certain temperature ranges, however, plastics are entirely satisfactory. The type of plastic referred to, for example, can be used at temperatures as low as 60 degrees F. below zero and up to 150 degrees F. above zero.

* * *

Twenty-Five Years of Standardization

The American Standards Association has just completed twenty-five years of service to American industry. It was started to aid in solving some of the production problems of the last war. During the past year, the Association has completed more than forty emergency standardization undertakings for the armed services and for industry, and is now engaged in many additional projects.

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Rust Preventive that Forms a Hard, Flexible Film

A new hard-drying rust preventive that provides a glossy, dry, thin film has been announced by E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia, Pa. This product, known as "Rust Veto 110A," is a light amber-colored liquid applied with a brush or spray. It dries in twenty-five to thirty minutes to a transparent film which is hard yet flexible at temperatures ranging down to minus 70 degrees F. The thickness of the applied film is about 0.0003 inch. The flash point of the material is 110 degrees F. When dry, the coating is non-inflammable. It adheres firmly to metal, even after being soaked in water for twenty-four hours. 201

New Non-Critical Plastic from Redwoods

A new non-critical phenolic type of thermoplastic has been developed from redwood by the Pacific Lumber Co., San Francisco, Calif., the Institute of Paper Chemistry, Appleton, Wis., and the Sheller Mfg. Corporation, Portland, Ind. The new plastic embodies in one composite form both resin and filler and is readily adaptable to either compression molding or to forming in the standard equipment of hard rubber plants. Exhaustive tests have shown that products made of this new plastic have good tensile strength and attractive appearance. It can be readily mixed with other resins and plasticizers when special properties are desired. 202

Silver Babbitts Developed as a Substitute to Save Tin

As a substitute for tin babbitts, two silver babbitts—Nos. 367 and 397—are being manufactured by the National Bearing Metals Corporation, 4930 Manchester Ave., St. Louis, Mo. These two grades of recognized lead-base babbitts containing silver were developed by the Battelle Memorial Institute, Columbus, Ohio, and have physical characteristics comparable to those found in tin-base babbitts. They exhibit a satisfactory retention of hardness at elevated temperatures, ease of bonding, resistance to squeezing out at operating temperatures, and a high degree of corrosion resistance. The new babbitts also have the ability to imbed grit which otherwise might scour the shaft.....203

A Hardening Solution that Obviates Tempering

A hardening solution that may be used with either water- or oil-quenching steels and which makes an additional tempering operation unnecessary has been introduced under the name "Steel-Temp" by the Steeltem Chemical Co., 51 E. 42nd St., New York City. The use of this solution is said to result in hardening the cutting edge of tool steel beyond the point obtained by ordinary quenching methods, while, at the same time, imparting toughness. 204

Thermoplastic Substitute for Gum Rubber

A new elasto-plastic known as "Marvinol," which is proving to be an excellent substitute for pure gum rubber, has been developed in the plastic research laboratories of the Glenn L. Martin Co., Baltimore, Md. The new material is not a synthetic rubber but a vinyl type thermoplastic with basic ingredients of coal, air, salt, and water. It has superior abrasion resistance, ability to withstand constant flexing without fatigue, and impermeability to gases and liquids.

Marvinol has proved especially useful in the making of inner tubes for automobile tires. Because of its exceptionally high impermeability to air, seepage through the side wall of the tube is practically eliminated; thus inner tubes made of Marvinol have traveled over 6000 miles each on Glenn L. Martin cars without having a single pound of air added to them after the tires were first placed on the wheels.

It is also an excellent material for the manufacture of industrial gloves. For this applica-

To obtain additional information on materials described on this page, see lower part of page 182.

tion, it exhibits superior ability to resist alkalies and acids in water solution. When used in the Martin photographic laboratories, gloves made of Marvinol showed only slight signs of deterioration after fifty-five days of almost constant use, while rubber gloves previously used under exactly the same conditions had become completely unserviceable in fourteen days.....205

New Hard Overlay Metal is Readily Applied

A new overlay metal, called "Kerk-Aloy," is a product of the Kerk-Aloy Co., Hollywood, Calif., an affiliate of Kerkling & Co., Bloomington, Ind. This metal is claimed to have exhibited unusual qualities of hardness, resistance to wear, thermal conductivity, low melting point, stability of temper, and is exceptionally easy to apply. It has shown a marked ability to bond homogeneously with any metal except lead and aluminum.

Because of its resistance to wear, it has been highly efficient for hard-facing harrow points, steam shovel lips and dredge lips or dippers, and other equipment where long hard service is the rule. It can be applied with an acetylene torch or an electric arc, and does not require the use of bonding fluxes. It flows evenly without the characteristic of gasification.....206

Penetrating Salt Bath for Blackening Steel Parts

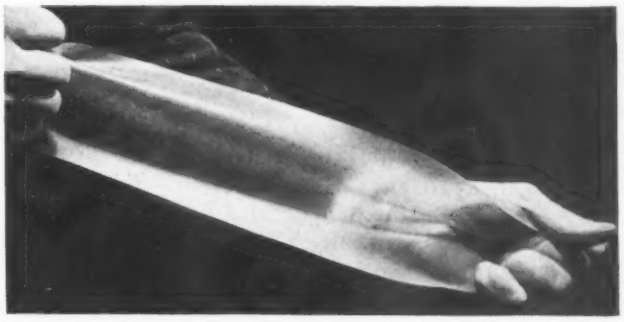
A fast acting, one-bath blackening process for all steels except stainless steel has been developed by the Mitchell-Bradford Chemical Co., 2446 Main St., Stratford P. O., Bridgeport, Conn. This bath, operating at 300 degrees F., produces a chemical reaction with steel, turning it a deep blue-black. The resultant finish is permanent in that it cannot be rubbed off and will not fade, chip, or peel. It withstands heat up to 1000 degrees F. without changing color. Steel parts can be shaped or drawn after finishing without disturbing the surface.

Originally an ordnance black oxide process for bluing small-arms components, ammunition, and magazines, it is now used either as a final finish or as an under coat or bond for lacquer and phenol varnish on a wide variety of war items, from shoe eyelets and clothing hardware to parts for cannon and tanks.....207

New Series of Solvent- and Wear-Resistant Synthetic Plastics

A new series of plastics has been developed by the Resistoflex Corporation, Belleville, N. J., to meet the demand for a flexible material which could withstand the action of toluol, xylol and benzol—important constituents of the new United States super-gasolines which quickly destroy most organic materials. These plastics, designated as "Compars," are described as transparent, flexible, rubber-like plastic materials that are five to twenty times more wear resistant than natural rubber. Some of these "Compars" are not only resistant to, but are chemically entirely unaffected by the action of organic solvents, including the aliphatic and aromatic hydrocarbons, the chlorinated hydrocarbons, the ketones, etc. Others exhibit low permeability to industrial refrigerant and military gases, high tensile strength, and freedom from aging or oxidation. Some varieties will remain flexible at temperatures as low as minus 70 degrees F., or as high as 300 degrees F. Others have been so modified as to be insoluble in water at all temperatures, with swelling and water absorption limited to 10 per cent.

One of the major applications for "Compars" is hose and hose assemblies to carry gasoline, oils, refrigerant, or other toxic gases. Transparent tubing is also being made from these synthetics, as well as molded products used as washers, gaskets, and seals which come in contact with organic solvents. In solution form, "Compars" are being used for coating wire baskets used for transporting and degreasing airplane and other metal parts, for oilproofing and solvent-proofing the welts and uppers of industrial shoes, and for painting the inside of wooden or composition boxes or chambers to make them entirely gasproof. 208



One of the Many New Compar Plastics Being Stretched to Show Its Elasticity. These New Plastics are Highly Solvent- and Wear-Resistant

To obtain additional information on materials described on this page, see lower part of page 182.

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 181 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the January Number of MACHINERY

Production Drilling and Boring Machinery

W. F. AND JOHN BARNES CO., 320 S. Water St., Rockford, Ill. Six loose-leaf catalogues covering multiple drilling and reaming machines; boring and facing machines; milling machines; deep-hole machines; miscellaneous machines; and standard hydraulic plant units. These catalogues are individual sections of a 50-page loose-leaf data book distributed to a selected list of buyers of new plant equipment. 1

Recording and Controlling Equipment

LEEDS & NORTHRUP CO., 4921 Stenton Ave., Philadelphia, Pa. The latest issue of *Modern Precision* shows various applications of Leeds & Northrup recording and controlling instruments in the process industries, ceramics industry, power plants, oil industry, metals industries, and research, teaching, and testing. 2

Taps and Dies

WINTER BROTHERS CO., Wrentham, Mass. Handbook and catalogue on taps and dies, containing tables of dimensions and prices, as well as engineering data of value to designers and users of taps and dies. Limited number of copies available to those requesting them on a company letter-head, addressed directly to the manufacturer..... 3

Electric Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Publication ET-1-A, on vacuum switches. Bulletin GEA-3706, on ignitron mercury-arc rectifiers for 501-kilowatt and higher ratings, 250 to 900 volts. Circular GEA-1607D, covering direct-current generators and exciters..... 4

Internal Grinding Handbook

NORTON CO., Worcester 6, Mass. Handbook entitled "The ABC of Internal Grinding," containing instructions for operators of internal grinding machines, covering selection of proper wheels for different jobs and how to correct common grinding faults. 5

Truck Lubricants

LUBRIPLATE DIVISION, FISKE BROS. REFINING CO., Newark, N. J. Circular outlining the advantages of "Lubriplate" for lubricating gears and bearings in trucks. Catalogue describing the advantages of the "Lubriplate" film in farm machinery. 6

Special Tool Handbook

U. S. TOOL & MFG. CO., 6906 Kingsley, Dearborn, Mich. Special Tool Handbook (60 pages) containing illustrations and line drawings of high-speed steel cutting tools, including milling cutters, forming tools, reamers, counterbores, and special tools. 7

Aids for Better Machining

DOALL CO., 1215 Thacker St., Des Plaines, Ill. Circulars on six DoAll products—DoAll steel ink for lay-out work, checking gear-tooth contact, etc.; 470 soluble oil; 120 and 240 cutting oils; "Saw Eez"—a sawing lubricant; grinding wheels; and abrasive bands..... 8

Hardening High-Speed Steel

PERFECTION TOOL & METAL HEAT TREATING CO., 1740 W. Hubbard St., Chicago, Ill. Circular descriptive of the "Nusite" process of hardening high-speed steel, "Silver Finish" hardening, and "Deepfreeze" hardening. 9

Precision Machine Tools

REED - PRENTICE CORPORATION, Worcester, Mass. Catalogue entitled "Facilities," showing typical examples of the line of precision machine tools made by the concern, as well as the manufacturing facilities of the company..... 10

Metal Cleaning

OAKITE PRODUCTS, INC., 26 Thames St., New York 6, N. Y. Manual on Oakite Compound No. 32, a material for removing hard water scales, rust, and similar deposits from machine equipment and other metallic surfaces..... 11

War Production Data

E. F. HOUGHTON & CO., 303 W. Lehigh Ave., Philadelphia 33, Pa. "War Production Data from the Houghton Line," comprising information on metal-working, heat-treating, and machining of armament. 12

Multi-Blade Adjustable Cutting Tools

ROBERT H. CLARK CO., 3424 Sunset Boulevard, Los Angeles 26, Calif. Folder descriptive of Clark three-blade adjustable hole cutters and other adjustable multi-blade cutting tools. 13

Belt-Drive Handbook

AMERICAN PULLEY CO., Department 132, 4200 Wissahickon Ave., Philadelphia 29, Pa. 70-page handbook describing American Econ-o-

matic drives, equipped with an automatic belt tension control feature. 14

Welding in Machine Design

LINCOLN ELECTRIC CO., Cleveland 1, Ohio. Machine Design Application Sheet No. 86, describing the design of a welded base for an injection molding machine. 15

Frog and Switch Planers

CINCINNATI PLANER CO., Cincinnati, Ohio. Circular entitled "Modernize Your Shop," announcing a new Hypro frog and switch planer for increasing production in railroad shops. 16

Retaining Rings

NATIONAL LOCK WASHER CO., Newark 5, N. J. Catalogue RR-YH-ZH, listing stock sizes of certain types of heat-treated spring steel retaining rings recently added to this company's line.....17

Inspection Tools

GEORGE SCHERR CO., INC., 128 Lafayette St., New York 13, N. Y. Booklet on the Scherr limited-budget inspection laboratory, briefly outlining this company's line of precision measuring tools.....18

Selection of Thermo-Couples

BRISTOL CO., Waterbury 91, Conn. Pyrometer Accessory Manual No. P1211, giving engineering data on the selection and installation of thermo-couples and other pyrometer accessories. 19

Hydraulic Cylinders

HYDRAULIC PRODUCTS CO., 525 W. 76th St., Chicago, Ill. Circular on hydraulic cylinders for operating the feed movements on machine tools and other industrial equipment. 20

Stainless-Clad Steel

JESSOP STEEL CO., Washington, Pa. Catalogue on stainless-clad steel, covering analyses, applications, methods of manufacture, fabrication, styles of heads, and standard sizes of sheets and plates available. 21

Hydraulic Milling Machines

SUNDSTRAND MACHINE TOOL CO., 2531 Eleventh St., Rockford, Ill. Bulletin 1-1, containing descriptive data and principal specifications covering the No. 1 hydraulic "Rigidmil" designed for milling small parts. 22

Diamond Powder for Lapping

J. K. SMIT & SONS, INC., 157 Chambers St., New York City. "Diamond Powder as a Lapping Compound"—a treatise contained in the company's publication "Diamonds in Industry."..... 23

Electrical Equipment

WAGNER ELECTRIC CORPORATION, 6467 Plymouth Ave., St. Louis, Mo. Catalogue descriptive of Wagner electric products and the part they have played in the War Production Program. 24

Roller Chain Belts for Aircraft

BALDWIN DUCKWORTH DIVISION OF CHAIN BELT CO., 369 Plainfield St., Springfield, Mass. Engineering Handbook No. 67, covering completely the design of machine-finished roller chain and its application to aircraft controls. 25

Electronic Control Equipment

WHEELCO INSTRUMENTS CO., Harrison and Peoria Sts., Chicago 7, Ill. Bulletin A2-3, describing Wheelco Potentiotrols, which employ the electronic principle to obtain instant and accurate temperature control. 26

Portable Electric Tools

SKILSAW, INC., 5039 Elston Ave., Chicago 30, Ill. Catalogue and Wartime Maintenance Manual, containing valuable suggestions on the care and operation of portable electric tools. 27

Hardening Taps and Dies

AJAX METAL CO., Frankford Ave. at Delaware Ave., Philadelphia 23, Pa. Circular containing an article on hardening high-speed taps and dies in the electric salt bath. 28

Hydraulic Bending and Beveling Machine

HUFFORD MACHINE WORKS, INC., Redondo Beach, Calif. Folder containing a suggested tooling method for the Hufford hydraulic bending and beveling machine. 29

To Obtain Copies of New Trade Literature

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[SEE OTHER SIDE]

Grinding Oils and Lubricants

WHITE & BAGLEY CO., Worcester 1, Mass. Bulletin showing applications of "Economy" grinding oils and lubricants for precision grinding in metal-working plants. 30

Air-Operated Gaging Equipment

SHEFFIELD CORPORATION, Dayton 1, Ohio. Engineering Data Sheet showing two applications of the "Precisionaire," an air-operated gaging instrument. 31

Carbide Tools and Blanks

KENNAMETAL, INC., 147 Lloyd Ave., Latrobe, Pa. Catalogue 43C, on standard Kennametal tools and blanks, containing latest reduced prices. 32

Hydraulic Arbor Presses

K. R. WILSON, 10 Lock St., Buffalo 2, N. Y. Bulletin descriptive of KRW hydraulic arbor presses ranging from 25 to 75 tons capacity. 33

Metal Spinning Data Book

MILWAUKEE METAL SPINNING CO., 1325 S. 43rd St., Milwaukee 14, Wis. Data book entitled "A Guide to the Use of Metal Spinnings in All Industries." 34

Collet Chucks

AIRCRAFT MACHINERY CORPORATION, Burbank, Calif. Circular illustrating and describing Armor collet chucks, with wedge-lock feature, for small lathes. 35

Straightening and Bending Presses

WATSON-STILLMAN CO., Roselle, N. J. Bulletin 320-A, covering the company's line of hydraulic straightening and bending presses. Engineering tables are included. 36

Selective Heat-Treatment

AJAX ELECTRIC CO., INC., Frankford Ave. at Delaware Ave., Philadelphia 23, Pa. Circular describing how Ajax-Hultgren salt bath furnaces speed up war production. 37

Hole Punching Units

WALES - STRIPPIT CORPORATION, 345 Payne Ave., North Tonawanda, N. Y. Catalogue C, illustrating and describing several types of Wales hole punching units. 38

Carbide Cutting Tools

ARCHER & SMITH, LTD., 125 N. Eastern Ave., Lexington 34, Ky. Catalogue 943, containing specifications on Archer & Smith flat carbide cutting tools. 39

Materials-Handling Machinery

YALE & TOWNE MFG. CO., 4530 Tacony St., Philadelphia 24, Pa. Booklet entitled "Modern Materials-Handling Machinery Applied to American Industry." 40

Precision Tapping

BAKEWELL MFG. CO., 2009 Santa Fe Ave., Los Angeles 21, Calif. Booklet entitled "Facts about Precision Tapping You Should Know." 41

Hydraulic Machinery

HYDRAULIC MACHINERY, INC., 12825 Ford Road, Dearborn, Mich. Catalogue on hydraulics as applied to machine tools and aviation. 42

Heat-Treating Furnaces

SURFACE COMBUSTION, Toledo, Ohio. Booklet entitled "The Heat-Treating Furnace—Yesterday, Today, and Tomorrow." 43

Management Engineering

PIONEER ENGINEERING & MFG. CO., 19669 John R St., Detroit 3, Mich. Pamphlet entitled "Solutions to Some Executive Problems." 44

New and Rebuilt Machinery

J. L. LUCAS & SON, INC., Bridgeport 5, Conn. Bulletin 110-S, listing new and rebuilt machine tools available for quick delivery. 45

Machine Tools

MILES MACHINERY CO., Saginaw, Mich. List No. 176, covering rebuilt machine tools. 46

Metal Cleaning

MAGNUS CHEMICAL CO., INC., Garwood, N. J. "Petroleum Cleaning Handbook." 47

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 183-202 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in January, 1944, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

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To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 178-179, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in January, 1944, MACHINERY.

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[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

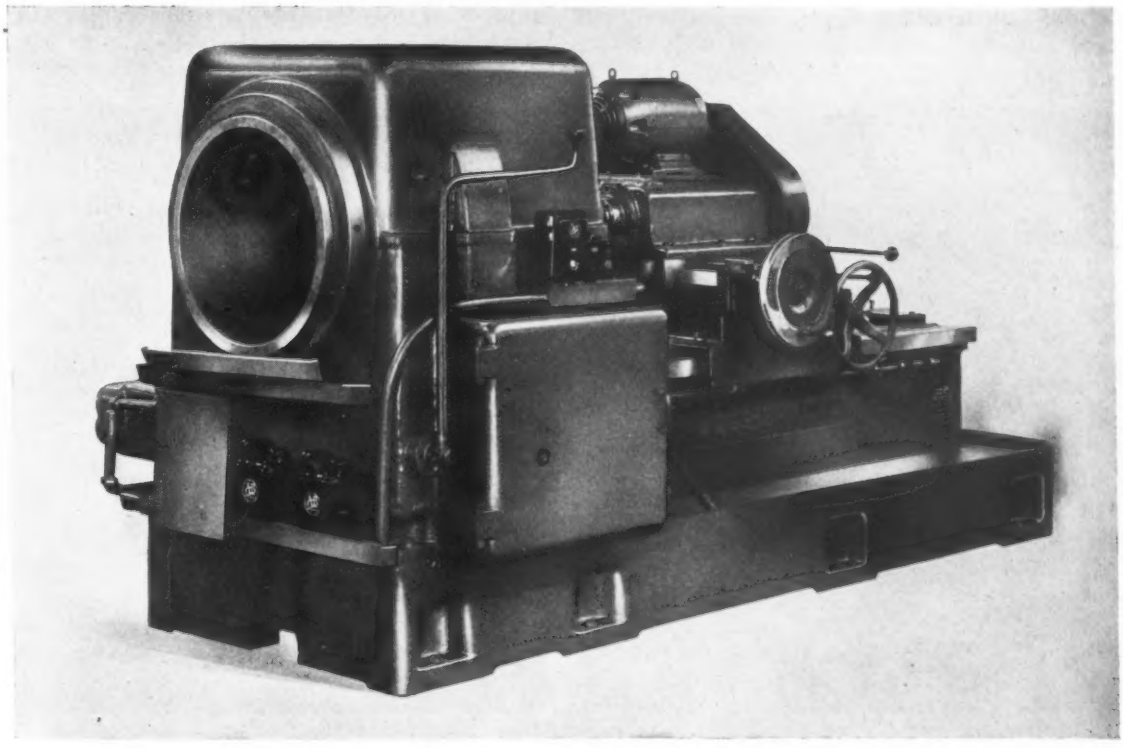
Lees-Bradner Heavy-Duty Chucking Thread Miller

The Lees-Bradner Co., Cleveland 11, Ohio, has recently developed a new chucking type thread milling machine of unusually large size, which is intended primarily for use in the strut and propeller divisions of the aircraft industry. This heavy-duty machine, designated Model STC, is equipped with a work-holding spindle having a hole 22 inches in diameter through its center. This increased work-holding capacity has been provided to accommodate the components of the larger aircraft now being built and in anticipation of still larger ones to come. The machine can be used for threading a variety of parts of the type which can be held in a suitably designed chuck for the ring type thread milling process.

The machine is equipped with individual motor drives, one motor furnishing power to the work-spindle, a second motor driving the cutter-spindle, a third motor supplying power for electric traverse, while a fourth motor drives the coolant pump. The work-spindle is driven by its motor through a gear-box and V-belts, the gear-box being arranged with pick-off gears for varying the work-spindle speeds. This drive has a clutch arranged to engage the work feed and the higher speed rapid traverse drive to the cutter-head. This permits the withdrawal of the cutter from engagement with the work to facilitate gaging operations, where it is necessary to maintain the correct relationship of the cutter to the cut taken for second operations after gaging.

Control of the clutch is by a handle located at the front of the machine. From the gear-box, the drive to the work-spindle is through a heavy-duty shaft, a worm, and a large-diameter precision worm-wheel that meshes with the worm. A gear-box is provided at the front end of the worm-shaft, where the pick-off gears for the various leads within the range of the machine are located.

The cutter-head of the machine, driven by a separate electric motor, is interlocked with the work-head drive motor and is arranged with a new type of cutter-spindle, the spindle being much larger than those formerly employed in thread milling machine installations. The spindle is mounted on Timken precision anti-friction bearings and is



Lees-Bradner Chucking Type Thread Miller Designed to Handle Large Work

To obtain additional information on equipment described on this page, see lower part of page 182.

equipped with multiple-row bearings at the front end. All of the thrust is taken through these bearings, the bearings at the rear of the spindle being of the cartridge mounted type to permit lengthwise expansion and contraction of the spindle.

A type of construction that is new to thread milling machine practice has been incorporated in the cutter-head to permit very rapid, and at the same time accurate longitudinal positioning of the cutter-head on the bed. The cutter-head is traversed along the bed by means of a separate motor having an integral brake. This drive is supplemented by a hand-operated drive, mounted directly on the cutter-head, which also permits accurate positioning of the head.

The standard Lees-Bradner mechanism for controlling the depth of cut when duplicating the pitch diameter of the thread on succeeding pieces has been incorporated in this machine. 51

Automatic Indexing Bases for Sundstrand Rigidmils

The Sundstrand Machine Tool Co., 2530 Eleventh St., Rockford, Ill., has brought out an automatic indexing base in two sizes, with tables 8 and 12 inches in diameter. The base with the 8-inch table is intended for use as an attachment on the Sundstrand No. 00 and No. 0 hydraulic Rigidmils, while the one with the 12-inch table is intended for the No. 1 hydraulic Rigidmil and the No. 2 Electromil.

These automatic indexing bases are designed for use in the horizontal position, as shown in Fig. 1, and in the vertical position, as shown in Fig. 2. The accuracy and automatic feature of these bases provide for continuous production to close limits. The attachments are sealed against dust, chips, or oil, and can be used for dry milling or for operations requiring a coolant. The bases can be supplied with new Sundstrand milling machines or for attachment to Sundstrand automatic milling machines already in use.

When mounted in the vertical position, the base can be used with a tailstock for milling splines, keyways, slots, and similar work. It can also be used in this position for milling parts chucked in line with the axis of the indexing base. The horizontally positioned index base can be used with station type indexing, making it possible to load one part while another part is being machined, extra fixtures being employed for this work. Castellated nuts and hexagonal and similar shaped parts can also be located on the axis of the indexing base in the horizontal position. Multiple cuts can be made with such set-ups without repositioning the parts.

Completely automatic operations consist of clamping the base during the cut, unclamping it after the cut, indexing the base to each station, and stopping on completion of the desired number of indexing movements. All these operations are automatically controlled by limit switches, actuated by movement of the milling machine table on which the base is mounted. The operator's duties are greatly simplified by this arrangement, making it possible for him to operate several machines, depending upon the work and the number of indexing movements required.

The selection of indexes is determined by a master and a mask plate. The master plate controls the maximum number of spaces in 360 degrees. There are thirty-six total indexing movements available with the 12-inch base, and twenty-four with the 8-inch base. Special master plates can be furnished to secure spacing combinations below thirty-six. Special mask plates can be supplied for uneven spacing..52

Imperial Flaring Tool for Plastic Tubing

A new flaring tool that is designed specifically for use with plastic tubing and that produces the

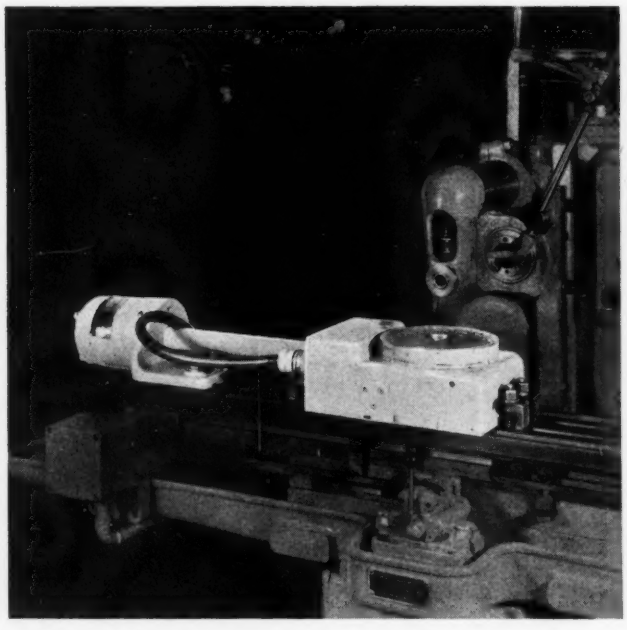


Fig. 1. Sundstrand Automatic Indexing Base for Horizontal Mounting on Rigidmil

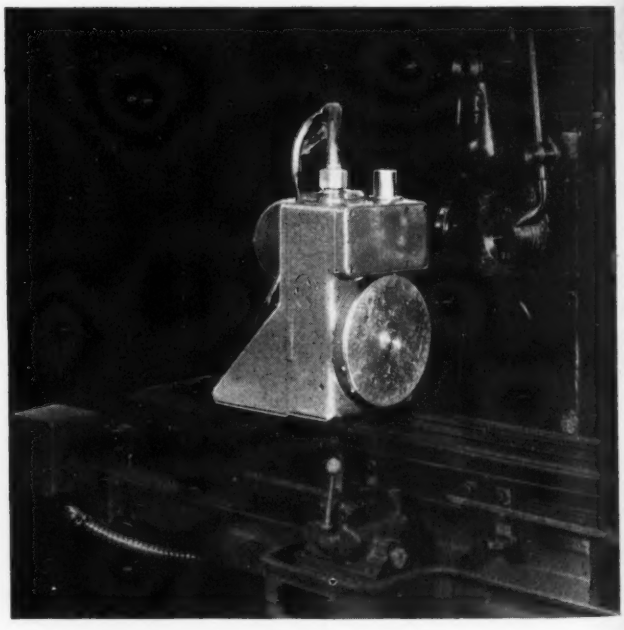
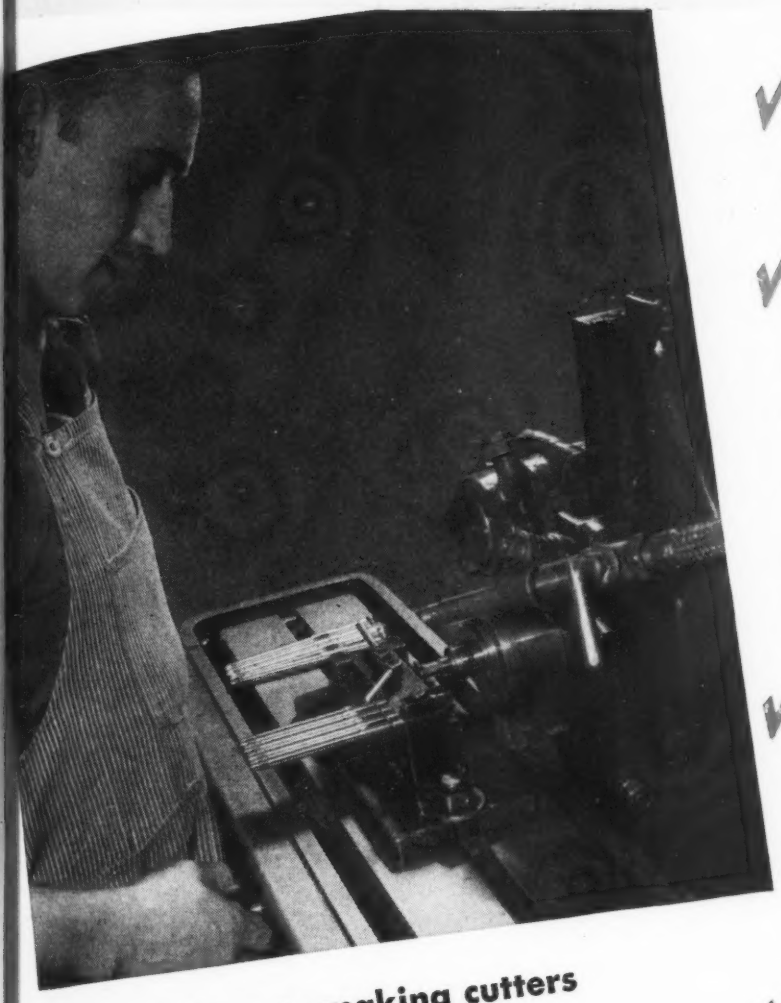


Fig. 2. Sundstrand Automatic Indexing Base Mounted in Vertical Position

To obtain additional information on equipment described on this page, see lower part of page 182.

No. 000 Conserves Your Milling Cutters

—Use this productive Brown & Sharpe Machine on the quality milling of small parts



✓ ***Rapid advance*** of work to cutting position by power.

✓ ***Accuracy*** of cutting feed engagement permits close timing and prevents jamming work into cutters — with consequent saving in cutter breakage.

✓ ***Steady, uniform feed*** gives longer cutter life, better finish and consistent production.

✓ ***Reduced cutter sharpening*** and replacement that conserves these urgently needed cutting tools.

In addition to making cutters go further, the No. 000 Plain Milling Machine has unusual production possibilities in the rapid milling of small parts on a wide variety of materials.

DELIVERIES ARE GOOD
on New No. 000 Plain Milling Machines

BROWN & SHARPE

approved type double thickness flare for connecting the tubing with flare type fittings, has been placed on the market by the Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago 7, Ill. This tool is similar in design and operation to the one developed for flaring metal tubing, which was described in November, 1943, number of MACHINERY on page 224. This new tool can be used for flaring plastic tubes 3/8, 1/2, 5/8 and 3/4 inch in diameter. It is designed especially for flaring tubes having a wall thickness of 0.062 inch, but will also handle tubing having a wall thickness of 0.031 inch.

The flaring produced by this tool is termed a "double flare" because the plastic tubing is folded back at the ends to form a flare with double-thick, double-strength walls. The complete tool consists of a flaring bar, yoke with a swivel cone, and four adapters, furnished in a metal kit or container. 53

Hydraulic Test Benches

Two models of hydraulic test benches have been built by Hydraulic Machinery, Inc., 12825 Ford Road, Dearborn, Mich. The Model T-116, which can be used for testing short lengths of hose or tubing, cylinders, etc., can be arranged for pressures up to 2000 pounds. It consists of a motor, pump, pressure relief valve, pressure shut-off valves, pressure and oil level gages, and necessary filters and baffles. This test bench is 21 by 38 inches by 40 inches high.

The Model T-110, shown in the illustration, is built to be used for instruction in hydraulics as applied to aircraft and machine tools. It can be employed for testing almost anything in the field of hydraulics. Some of the principal features include oil flow meters tabulated in gallons per minute; variable-speed fluid motor used as a power drive for testing various types of pumps; speed control valves; electrically and manually controlled valves; pressure and oil temperature gages; and an aircraft type spherical accumulator.

The electrical equipment consists of push-buttons for all electric motors and electrically controlled directional valves with pilot lights to indicate when the circuits are closed. This test bench is 40 inches deep, 84 inches long, and 77 inches high, and has a working table 37 1/2 inches high by 29 inches wide by 84 inches long. 54

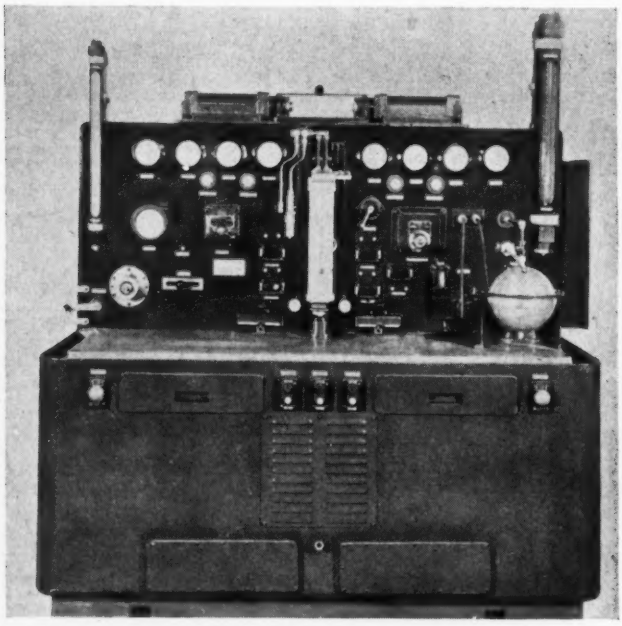
Hanchett Vertical-Spindle Rotary Surface Grinder

A No. 24 vertical-spindle rotary surface grinder has recently been added to the line of grinders made by the Hanchett Mfg. Co., Big Rapids, Mich. The structural members of this new grinder have been made considerably heavier and stronger to insure precision and long service.

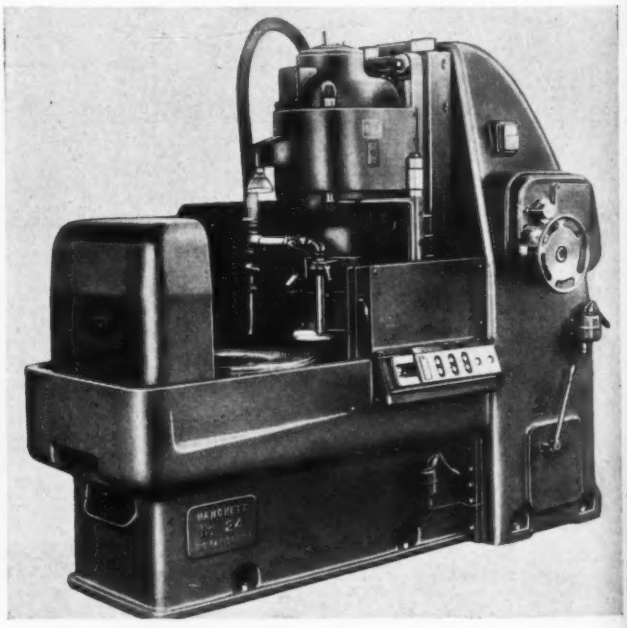
The 30-inch rotary magnetic chuck is equipped with a Neu-T-Rol demagnetizing switch and is traversed into the grinding position by push-button control. The grinding wheel head has hand, power, or automatic traverse movements, the power traverse being furnished by a 2-H.P. motor having a speed of 900 R.P.M. The motor-driven wet grinding system includes a coolant pump driven by a 1/2-H.P. motor. The grinder is equipped with a rugged swing arm type wheel dresser, ammeter for determining the cutting action of the grinding wheel, floodlight, and other accessories designed to facilitate accurate grinding. 55

Engis "Hyprez" Precision Finishing Service for Metal Parts

A method of applying a high precision finish to metal parts, known as "Hyprez," has been developed by the Engis Equipment Co., 310 S. Michigan Ave., Chicago 4, Ill. This company is prepared to apply the finish to parts already made, as well as to supply complete parts finished by the new method, ready for assembly.



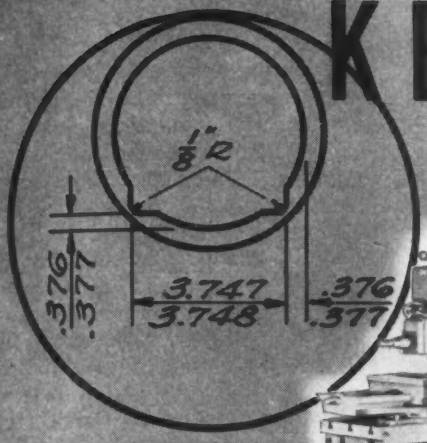
"Hy-Mac" Test Bench for Hydraulic Equipment

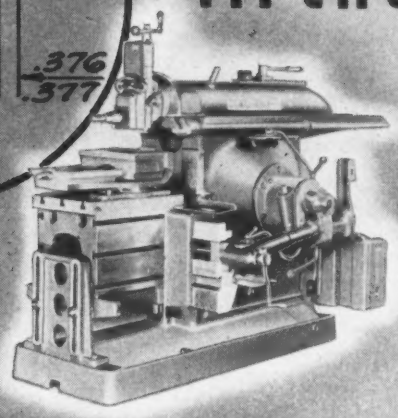


Hanchett Rotary Type Surface Grinder

To obtain additional information on equipment described on this page, see lower part of page 182.

KEY WAYS
...the right way !





. . . . Internal shaping is another function of the Shaper requiring accurate performance. Here a Cincinnati Shaper holds close tolerances cutting Kennedy Key Ways in an eccentric.

Write for Catalog N-2

THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

The Hyprez finish is obtained by employing abrasives of the highest quality with a new technique developed to eliminate scratches. The method is claimed to assure a finish of superior quality on surfaces previously machined, ground, honed, or lapped. Even under strong magnification, the finished surface is said to present a uniform appearance without the usual pronounced scratch pattern.

The Hyprez finish is being applied to ball-bearing races, instrument pivots, cartridge-case dies, the bores of gears, hydraulic cylinders, and many other parts for which frictionless movement is desired. The process is particularly adaptable to straight and tapered holes or bores, and to contoured parts, including spherical- and conical-formed surfaces that are difficult to finish by other methods. The amount of stock removed by this finishing method varies with the quality of surface before finishing, the depth of its deepest scratches or imperfections, and the hardness of the piece.....56

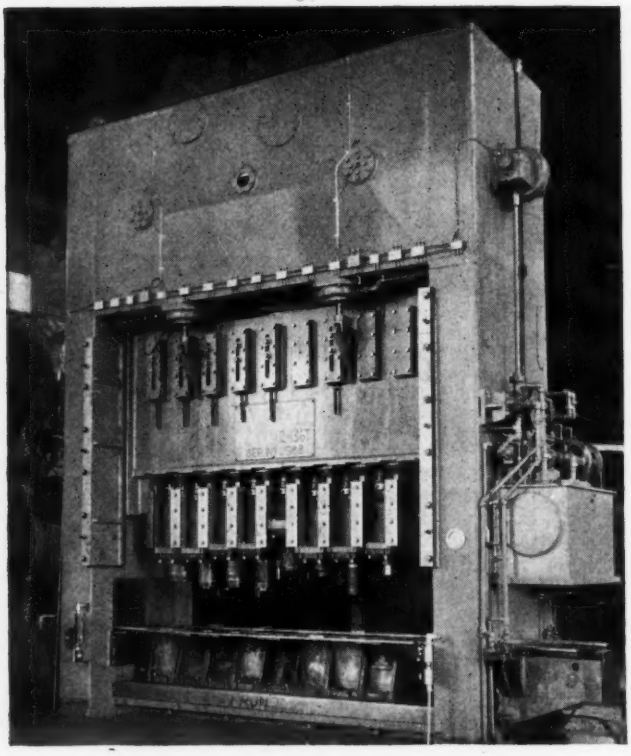
Verson Eccentric Press with Transfer Feed

A full eccentric type transfer feed press has been designed and is being manufactured by the Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill., for use in manufacturing parts for such products as coaster wagons, cooking utensils, and other commodities. The press shown in the accompanying illustration was built for the manufacture of filters. It is equipped with nine stations and performs such operations as blanking, drawing, redrawing, piercing, sizing, and embossing filters. The rate of production is 720 pieces per hour. This huge machine has a capacity of 500 tons and measures 138 inches between the housings. All working stations are interchangeable and adjustable.

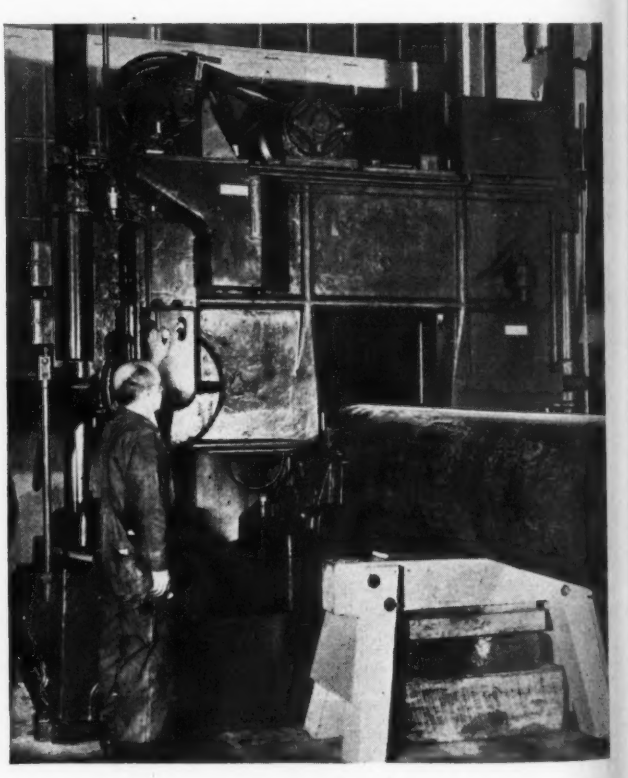
Force is applied at two points to insure an even distribution of pressure across the entire slide area. The slide and frame are of characteristic Verson Allsteel welded construction designed to offer maximum resistance to torsional twist and deflection, and thus insure accuracy and long life for the punches and dies. The full eccentric construction of this press has been designed to guard against structural weakness. The split cap design of the bronze-bushed main bearings permits easy renewal and quick adjustment. An extra long full-thrust eccentric strap is employed to reduce friction between the gibs and slide. Barrel type adjusting screws with buttress threads remain vertical at all positions of the stroke and virtually eliminate bending moments. This press is available in a wide range of sizes and tonnage capacities. 57

Marvel Universal Hacksaw for Cutting off and Trimming Large Billets and Forgings

The Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago 39, Ill., developed and recently built the No. 24 Marvel universal hydraulic roll-stroke hacksaw machine shown in the accompanying illustration. This illustration shows the saw installed in the plant of the Mesta Machine Co., where it is being used for sawing alloy shafts 22 inches in diameter. This hacksaw is believed to have the largest capacity of any machine of its type ever built. It is designed to cut off bars or forgings 24 by 24 inches, but has a maximum capacity for



Eccentric Press with Transfer Feed, Made by Verson Allsteel Press Co.



Marvel Universal Hacksaw Developed by the Armstrong-Blum Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 182.

cutting off sections up to 25 by 26 inches.

The machine was developed to meet the need for a saw that would cut off or trim large billets, blocks, and forgings accurately at a fast rate, and yet retain the advantages of low initial cost, low tool cost, small chip loss, low power consumption, simplicity of operation, and low maintenance cost. It takes a special saw blade 36 inches long, 4 1/2 inches wide, and 1/8 inch thick, with 2 1/2 teeth per inch. This blade is of the unbreakable composite Marvel type employing high-speed steel teeth in a tough alloy body. The machine requires a floor space of 56 by 122 inches, and weighs 16,000 pounds. 58

Improved Light-Duty Tapping Machines

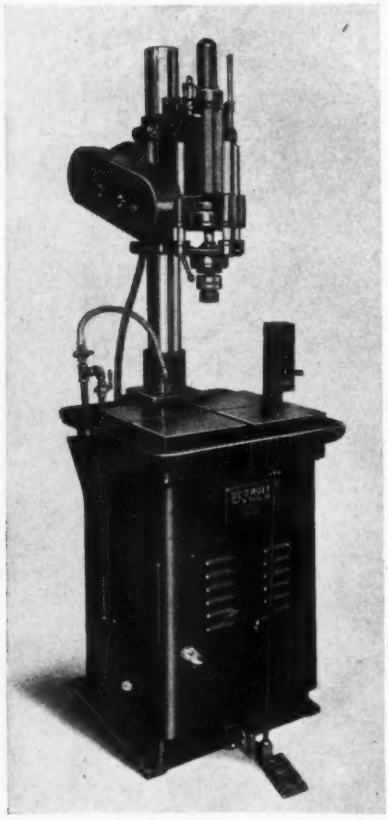
A new series of improved light-duty lead-screw type tapping machines has been announced to the trade by the Detroit Tap & Tool Co., 8432 Butler Ave., Detroit 11, Mich. These machines are designed for precision production tapping of 7/8-inch 14 pitch threads in mild steel. Improved features designed to increase the accuracy of the machines are sturdy guide rods for controlling the tapping spindle and a movable head that guides the driving end of the tapping spindle. The tapping spindle is driven at a point between the tap and the lead-screw itself. This arrangement removes the driving load from the lead-screw and thus eliminates the possibility of inaccuracies occurring because of the so-called lead-screw "wind-up" or torque.

The lead-screw and bronze lead-screw nut are of the interchangeable type and can be removed as a unit after the removal of the dust-cap and one screw. The two-piece lead-nut can easily be adjusted to take up wear and backlash.

The tapping head and motor can be raised and lowered to accommodate work of varying heights and can also be adjusted horizontally through an arc of approximately 90 degrees, making it possible to tap at different positions on the table or fixture. Multiple tapping heads can also be applied, if desired. The standard table is square and is provided with T-slots. A rotary indexing type work-table 15 inches in diameter is also available. Pedal control is provided to facilitate locating the work.

Interchangeable pulleys with V-belt drive provide spindle speeds of 64, 160, and 400 R.P.M. Pulleys for other speed combinations can be supplied. The motor is so mounted as to facilitate belt changing and adjustment. The drive has a friction clutch that can be set to prevent tap breakage.

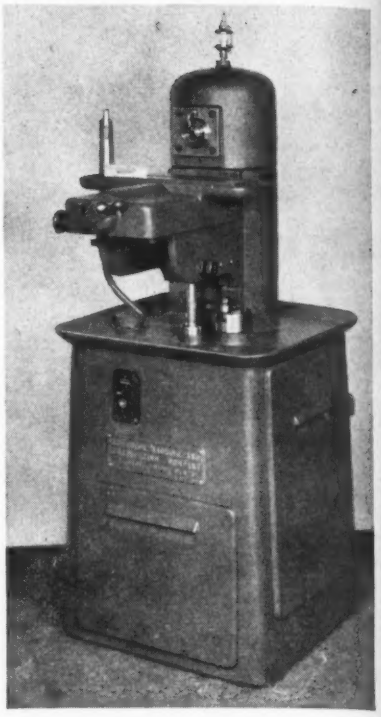
The tapping cycle is controlled by limit switches. The trip-dogs which contact the limit switches can be adjusted to give any desired length of tapping stroke within the capacity of the machine. A push-button serves to start the machine, after which the spindle travels to the bottom of its stroke, automatically reverses, and then stops at the top of its stroke. Emergency stop and reverse buttons are provided. 59



Light-duty Tapping Machine Made by the Detroit Tap & Tool Co.

Slot-Milling Machine

The Superior Machine & Engineering Co., 1930 Ferry Park, Detroit 8, Mich., has recently brought out a slot miller designed for the rapid and accurate milling of slots in pieces of various shapes and sizes. A two-lip end-mill is used in the spindle head, which oscillates in an arc while the end-mill is revolving. The part to be slotted is held in a fixture on the work-table and is fed to the oscillating tool at each end of the stroke. This feed is automatic, the amount being adjustable to suit the work. The feed automatically stops at the end of the cutting action or can be stopped manually at any time.



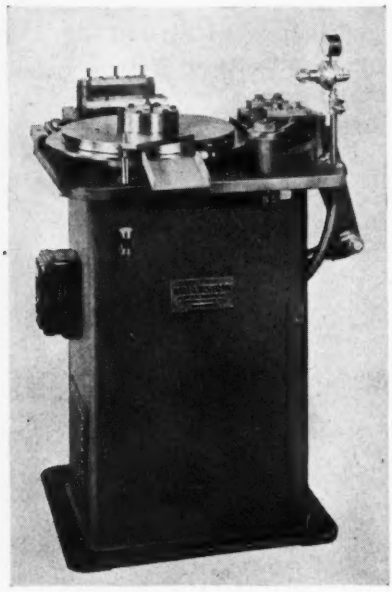
Slot-milling Machine Brought out by Superior Machine & Engineering Co.

The end-mill is held in a collet in the oscillating spindle. The width of slot is determined by the diameter of the cutter and the length of the slot by the chord of the arc of oscillation. The amount of oscillation is determined by an adjustable throw crank. The machine is driven by a motor mounted in the base. Means are provided for changing the speed of the spindle to suit the diameter of the cutter used. A pump in the machine base keeps the cutter flooded with coolant.

The automatic feed to the table is 4 inches and the feed range per oscillation is from 0.0011 to 0.0089 inch. The working surface of the table is 3 1/2 by 13 inches. The height of the center line of the spindle above the table is 3 1/2 or

To obtain additional information on equipment described on this page, see lower part of page 182.

4 5/8 inches. Spindle speeds of 1560 and 2040 R.P.M. are available. Six oscillating speeds range from 32 to 93 per minute. The maximum length of oscillation recommended is 3 inches. The machine occupies a floor space 20 1/2 by 32 inches, weighs 760 pounds, and is driven by a 1/2-H.P. motor. 60



Noble & Westbrook Marking and Knurling Machine

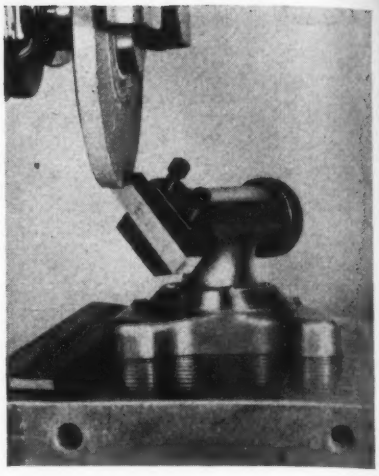
Combination Marking and Knurling Machine

A combination high-speed precision marking and knurling machine has recently been placed on the market by the Noble & Westbrook Mfg. Co., Westbrook St., East Hartford, Conn. This new machine is designed to impress the knurling, customer's name, part number, and other identification data permanently into socket-wrench parts. The marking and knurling operations are completed in a single pass of the work through the machine. The operator simply loads the pieces on the carrier dial, which revolves continuously and carries them along to the points where they are knurled, marked, and unloaded automatically. This particular machine is tooled up for socket-wrench parts, but it can be used for marking or knurling other work of similar nature.

The knurling on either one or two bands is performed in the first position, being accomplished with concave knurls under pressure which produce either angular or vertical cross-line scores. The knurling die is mounted in a special holder which has a compensating spring device that automatically takes care of slight variations in the diameter of the work. After the part is knurled, it travels along to the position where the data is permanently applied by flat marking dies set in a holder having a standard dovetail shank which provides for vertical adjustment. At this point, pneumatic die pressure is used which can be adjusted from 10 to 100 pounds. By using additional pressure dials, work-pieces and diameters up to approximately 4 inches can be accommodated. 61

Boyar-Schultz Universal Tool-Bit Grinding Fixture

The Boyar-Schultz Corporation, 2110 Walnut St., Chicago 12, Ill., has just completed development of a Model G universal tool-bit grinding fixture for grinding screw machine tool bits. With this universal grinding fixture mounted on a surface grinder, an inexperienced operator can quickly produce uniformly ground tool bits for both right- and left-hand screw machine tools. Any desired chip-breaker angle can be ground to suit any type of material.



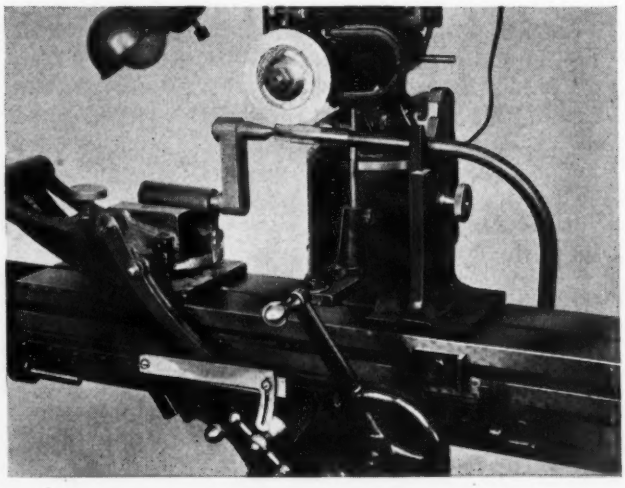
Tool-bit Grinding Fixture Made by Boyar-Schultz Corporation

The fixture can be adjusted to duplicate angles with the assurance that all bits will be ground exactly alike. 62

Circular Relief Grinder for Bent-Shank Taps

A true circular relief can now be ground on bent-shank or long-lead taps with the circular relief grinder equipped with special attachments brought out by the Cleveland Tool Engineering Co., 1259 W. 4th St., Cleveland 13, Ohio. This equipment can be used for resharpening or regrinding taps as many as ten times. It will accommodate any size of ship or boiler reamer or tap, including all bent-shank taps. Centering of the tap and holding it in place during the grinding operation are accomplished by a constant-height V-block which is used in conjunction with an offset center, as shown in the illustration. While extremely simple in both principle and operation, this block affords the unique advantage of enabling the most inexperienced operator to quickly center a tap of any diameter.

Following the exact outside contours of the tap or reamer is accomplished automatically. By merely setting the graduated adjustable cam to the correct position, equal relief is given to each cutting



Cleveland Grinder and Attachment for Grinding Circular Relief on Bent-shank Taps

To obtain additional information on equipment described on this page, see lower part of page 182.

TOOLS LEAD A DOUBLE LIFE

SUNICUT

increases tool life 100%... improves finish of parts

Tools can't take a holiday . . . not when there are guns to make, and bombers to build, and other war material to produce. But tools were taking holidays . . . far too many . . . for regrinding and resharpening at one of the largest mid-west war plants.

Production quotas were a headache to machine tool operators and foremen because the frequent "time-outs" for tool changes cut down the output. In addition the finish of the parts was not up to par. Many grades and brands of cutting oil were tested and tried, but all failed to correct the condition. So they called a Sun Doctor of Industry — a cutting oil expert — who studied the problem and recommended a change to Sunicut, the transparent, sulphurized oil.

Tools double parts produced for tool grind on many operations before they need changing . . . and the finish of the parts is everything that could be desired. Sunicut succeeded where the others failed.

Output is stepped up in this war plant because the high heat-absorbing and metal wetting properties of Sunicut permitted longer tool life and finer finish. How about investigating the production-boosting possibilities of Sunicut in your plant? A Sun Oil Engineer will be glad to discuss it with you. Write

SUN OIL COMPANY • ***Philadelphia 3, Pa.***

Sun Oil Company, Ltd., Toronto, Canada

SUNOCO

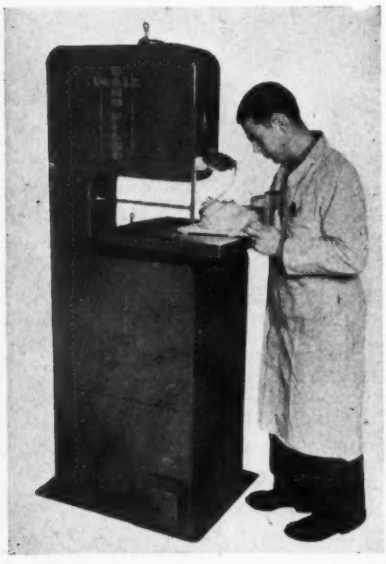
SUN INDUSTRIAL PRODUCTS HELPING INDUSTRY HELP AMERICA

edge of the tool. Since each regrind duplicates the original or factory grind, the number of grinds and the total output of each tool is increased many times, thus effecting large savings in replacements alone. ---- 63

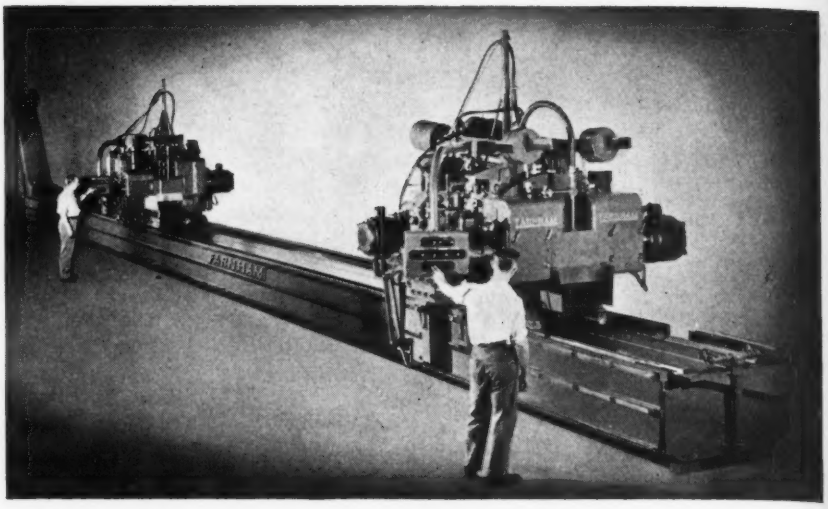
DoAll Band Filing Machine

A new continuous band filing machine has been brought out by Continental Machines, Inc., 1301 Washington Ave., S., Minneapolis 4, Minn., to meet the need for a low-cost machine of this type for file broaching operations on metals, alloys, plastics, fibers, and wood. This machine is similar in appearance and construction to the Continental DoAll contour machine. It is claimed that with this machine, comparatively unskilled operators can produce work equal or superior to that of expert hand workmen.

Twelve different types and sizes of file bands for use on this new machine are available, ranging from 1/4 to 3/8 inch wide, in oval, half round, or flat shapes. These sizes permit filing even intricate work to tolerances of less than 0.001 inch. Internal filing work is performed as easily as external work by merely unsnapping the file band and threading it through the work. The machine has a throat capacity of 15 1/2 inches, and will take work up to 6 inches in thickness. The variable-speed drive provides a cutting speed range of 50 to 250 feet per minute.----64



DoAll Continuous Band Filing Machine



Farnham Airplane Spar Miller Believed to be the Largest Machine of This Type Ever Built

Farnham Spar Miller of Huge Proportions

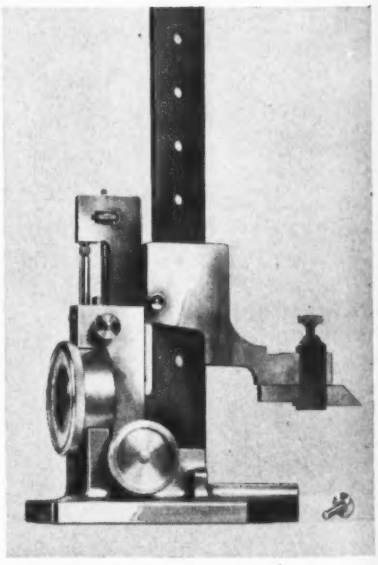
The Farnham Mfg. Co.,. 1646 Seneca St., Buffalo, N. Y., has recently built for a well-known aircraft manufacturer what is believed to be the largest airplane spar miller in the world. This huge machine, designed for the Farnham Mfg. Co. by Paragon Research, Inc., engineers, is similar in principle to previously built Farnham high-speed spar millers now in use in the production lines of leading aircraft manufacturers.

The over-all length of the machine is 91 feet, and the table length 80 feet. The two carriages of this machine have a total of six milling spindles, and travel the length of the bed during the milling operation. The carriages operate independently, but are used simultaneously when milling long spars, performing as many as six operations at a time. The carriages can also be operated independently on short-length spars. ----65

Vincent Height Gage

A height gage representing a radical departure from the design of conventional vernier height gages has been brought out by the Vincent Co., P. O. Box 1895, Boston 5, Mass. This new gage is so designed that the height of the scriber or measuring jaw above the surface plate on which the gage rests can be easily read at any time to 0.001 inch. It consists of a channeled unit housing, a dial indicator graduated from zero to 100 on the large dial and zero to 10 on the counter dial.

The channeled, hardened, ground and lapped base supports a gooseneck column having hardened, ground, and lapped bushings located in holes bored with a jig borer at 1-inch intervals. The column carries a horizontal arm equipped with a scriber or measuring contact surface jaw. This arm can be accurately located at any of the 1-inch intervals by plugging a locating pin in the required bushing in the column. Near the locating plug is a window through which can be read the height setting in inches above the surface on which



Height Gage Brought out by the Vincent Co.

To obtain additional information on equipment described on this page, see lower part of page 182.

Standard Carboloy Tool Prices Now Generally Comparable to All Types of Cutting Tool Materials

THE STEADY INCREASE in acceptance of of Standard Carboloy Tools has made possible constant improvement in our quantity manufacturing technique to the point where highly efficient single-purpose equipment has been developed for practically all operations, effecting substantial economies in our mass production methods.

This has made possible a further price reduction—effective December 6, 1943—in the price of single point Standard Carboloy Tools to a level where they are now generally comparable, in price, with tools made of *ALL* types of cutting materials. These new, low prices now justify—more than ever before—your review of all single point tool turning, boring and facing applications not at present receiving the benefits of carbide use—in terms of increased production, faster machining speeds, better finish, longer tool life and lower cost per piece produced.

Send for revised price list covering 10 Standard Styles, 5 Standard Grades, for cutting steel, cast iron, non-ferrous metals, etc.

CARBOLOY COMPANY, INC., 11147 E. 8 MILE BLVD., DETROIT 32, MICHIGAN

Birmingham · Chicago · Cleveland · Los Angeles · Newark · Philadelphia · Pittsburgh · Seattle · Thomaston, Conn.

CANADIAN DISTRIBUTOR: Canadian General Electric Company, Ltd., Toronto, Ont.

FOREIGN SALES: International General Electric Company, Schenectady, N. Y.

CARBOLOY

TRADEMARK

For Cutting CAST IRON and Non-Ferrous Metals

For Cutting STEEL

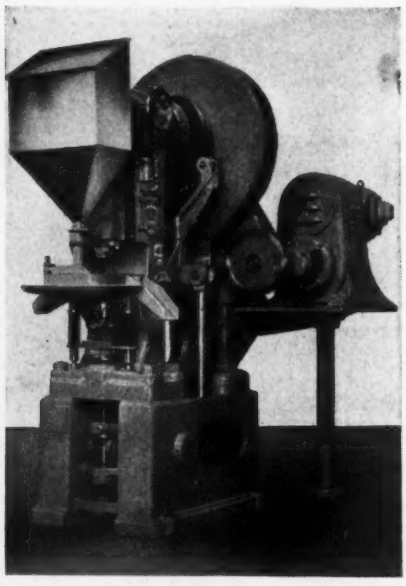
TUNGSTEN CARBIDES * TUNGSTEN CARBIDES WITH TANTALUM AND/OR TITANIUM CARBIDES**

the gage rests when the counter dial and dial indicator both read zero. Thus the gage can be read or set by adding to the figure shown through the window near the locating plug, the figures or readings of the counter and the dial. If the figure read through the window is 7, the counter reading 8, and the dial reading 47, the setting would be 7.847 inches. ----66

Automatic Press for Forming Powdered-Metal Parts

An improved Model R-4 automatic press has been developed by the F. J. Stokes Machine Co., Tabor Road, Olney P. O., Philadelphia, Pa., especially for the high-speed production of powdered-metal parts in which accuracy of dimensions and exacting control of density are primary requisites. Pieces up to 3 inches in diameter with a die-fill of 2 5/8 inches can be compressed by this machine at rates of 15 to 45 per minute. Pressures up to 20 tons can be applied to both the top and bottom of the dies. Pressure adjustments can be made during an operation; thus the density of the piece produced can be controlled with great exactness. For example, either the desired porosity in oil-impregnated bearings or the extreme density necessary in a carbide tool bit is readily obtainable.

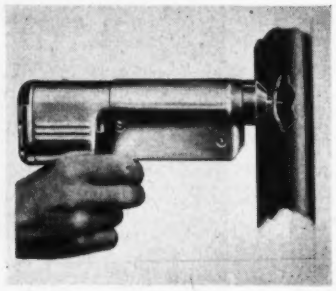
Features of this new press include extra heavy construction; separate ejection and compression levers; screw adjustment for compression; independent injection cam; twin disk clutch and combined brake that instantly starts and stops the machine, even under full compression load; variable-speed drive for obtaining maximum production with materials and parts of varying characteristics and size; and adjustable gibs to maintain close accuracy in punch and die alignment. ----67



Stokes Automatic Press for Forming Powdered-metal Parts

Thor Blind-Rivet Driver

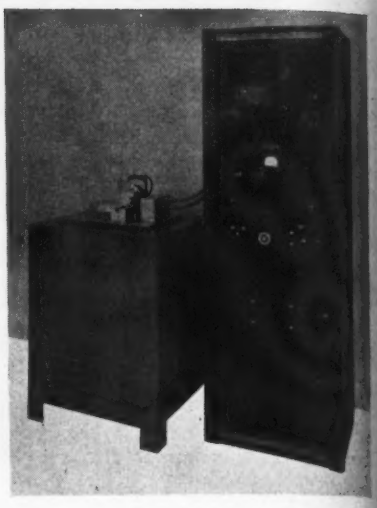
A pneumatically operated portable tool that will drive and "buck" or head in one speedy operation the "blind" rivets on finished air-plane sections to which are connected de-icers, instrument panels, and other light weight assemblies has been brought out by the Independent Pneumatic Tool Co., 600 W. Jackson Boulevard, Chicago 7, Ill. This new tool, designated as the "Thor-Riv-Driver" is designed to drive four flat or countersunk head "Rivnut" blind rivets a minute. A light at the top of the handle flashes "O K" to indicate to the operator when the rivet has been accurately upset on the blind side.



Portable Blind-rivet Driver Made by Independent Pneumatic Tool Co.

In the first step of the operating cycle, the mandrel of the tool is screwed into the threaded "Rivnut"; in the second step, the mandrel is pulled back, upsetting the rivet and flashing the "O K" signal; in the third step, the mandrel is unscrewed from the "Rivnut"; and in the fourth and final step, the power is shut off.

The complete tool weighs 4 1/4 pounds, measures 9 1/2 inches in length, has a spindle offset of 7/8 inch, a forward speed of 100 R.P.M., and a reverse speed of 2000 R.P.M. ----68



"Electrodynascope" High-speed Balancing Machine

High-Speed Balancing Machines

The Sonntag Scientific Corporation, 1 Seneca Place, Greenwich, Conn., has acquired the right to manufacture and market a new type of high-speed balancing machine developed by William Hovgaard, of the Gyro-Balance Corporation, under the trade name "Electrodynascope." This machine differs from conventional balancing machines in that it measures directly the alternating bearing forces exerted by the unbalance of the rotor rather than the tangible displacement of the balancing parts.

Alternating unbalanced forces are transmitted by a practically rigid platform to quartz crystals that produce piezo-electric potentials which are magnified by vacuum tube amplifiers and made visible on the screen of a cathode ray oscillograph. The magnitude of the unbalance, expressed in ounce-inches or depth of drilled or milled balancing holes, is indicated as a sine wave pattern, representing magnitude and location of unbalance.

Since centrifugal forces are measured instead of the displacement caused by such forces, and since the rotor is mounted on rigid supports having a natural frequency considerably above the balancing speed, inertia forces are negligible and indications are independent of the weight of the rotor. Standard models of this machine for balancing rotors up to 75 pounds in weight at speeds up to 12,000 R.P.M. are available.

To obtain additional information on equipment described on this page, see lower part of page 182.

The illustration shows a machine equipped for balancing gyro rotors. The rotor is mounted on rigid bearing supports, and the entire assembly is seismically suspended on springs to eliminate disturbing influences of floor vibrations. The electronic control cabinet is shown at the right. The cathode-ray screen, which appears at eye level, is graduated horizontally into 360 degrees for reading the location of unbalance, and vertically into units representing the amount of unbalance. Most machines are driven by a small air turbine wheel which slides over the end of the shaft to be balanced. 69

Preis Pantographic Engraving Machine

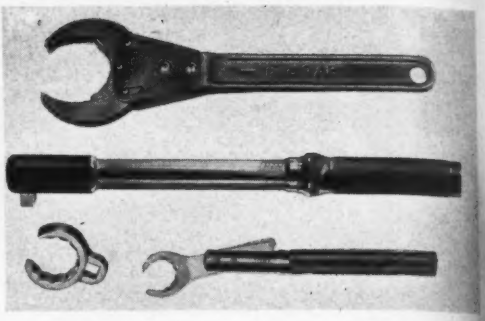
The H. P. Preis Engraving Machine Co., 157 Summit St., Newark 4, N. J., has recently added to its line of "Panto" engraving, marking, and etching machines a new unit designed for heavier and more varied engraving work than that performed by its standard Model UE machines. The new machine, designated "UE-3 Panto Engraver," is suitable for engraving on all metals and plastics, for electrical marking on steel and other ferrous metals, and for use in applying the acid etching process on metals or glass.

The UE-3 engraver can be equipped with a forming guide attachment to permit engraving work with concave, convex, spherical, and beveled surfaces. A regulator for the depth of cut is available for use in engraving uneven or curved surfaces. The pantograph ratios range from 1.7 to 1 up to 7 to 1, with all of the principal ratios marked on the bars to facilitate accurate setting. Any intermediate ratio setting is easily obtained from a pantograph chart furnished with the machine.

The cutter-spindle has adjustable ball bearings and is held in the spindle bracket with a bayonet type lock, which permits it to be easily inserted or removed. Straight-shank cutters or the standard GA tapered shank cutters can be used. The machine is equipped with an endless belt drive and has four spindle speeds ranging from 5000 to 12,000 R.P.M.

The motor, mounted on the base in back of the pantograph carrier, remains in a stationary position. The cutter is fed to the work with a cam-actuated drop lever, the feed-screw collar being graduated to 0.001 inch. The total vertical feed is 5/16 inch. The maximum distance from the cutter point to the work-table is 3 inches. Standard work-table dimensions are 6 by 12 inches. This table has three T-slots, and is adjustable both horizontally and vertically. 70

Preis Pantographic Engraving Machine



(Top) "Joar" Conduit Wrench. (Center) "Jomi" Torque Wrench with Micrometer Adjustment. (Bottom) "Jobe" Tension Wrench

Conduit and Torque Wrenches for Aircraft Fittings

Joyce & Associates, 819 Washington Bldg., Los Angeles 13, Calif., have placed on the market three new wrenches of the designs shown in the accompanying illustration. The conduit wrench, shown in the upper view of the illustration, is made in various sizes for quick-action tightening or loosening of all standard sizes of knurled or serrated fittings for conduit or conduit plugs and tubing now in use on aircraft without marring or distorting the parts. This self-ratcheting wrench can be used with equal facility for turning fittings in either a clockwise or counter-clockwise direction.

The radically new type of torque wrench shown in the central view of the illustration has a micrometer type adjustment with inch-pound calibrations on the barrel. The mechanic or inspector simply turns the handle of the wrench until the desired torque marking is opposite the indicator and locks it at this setting by turning a knurled locking ring. The wrench is designed to give the operator a signal when the required torque is attained. The small head of the wrench permits it to be used in restricted working spaces with standard sockets or a jaw of the type shown in the lower left-hand corner of the illustration. These wrenches are made in sizes covering a torque range of from 10 to 2000 inch-pounds.

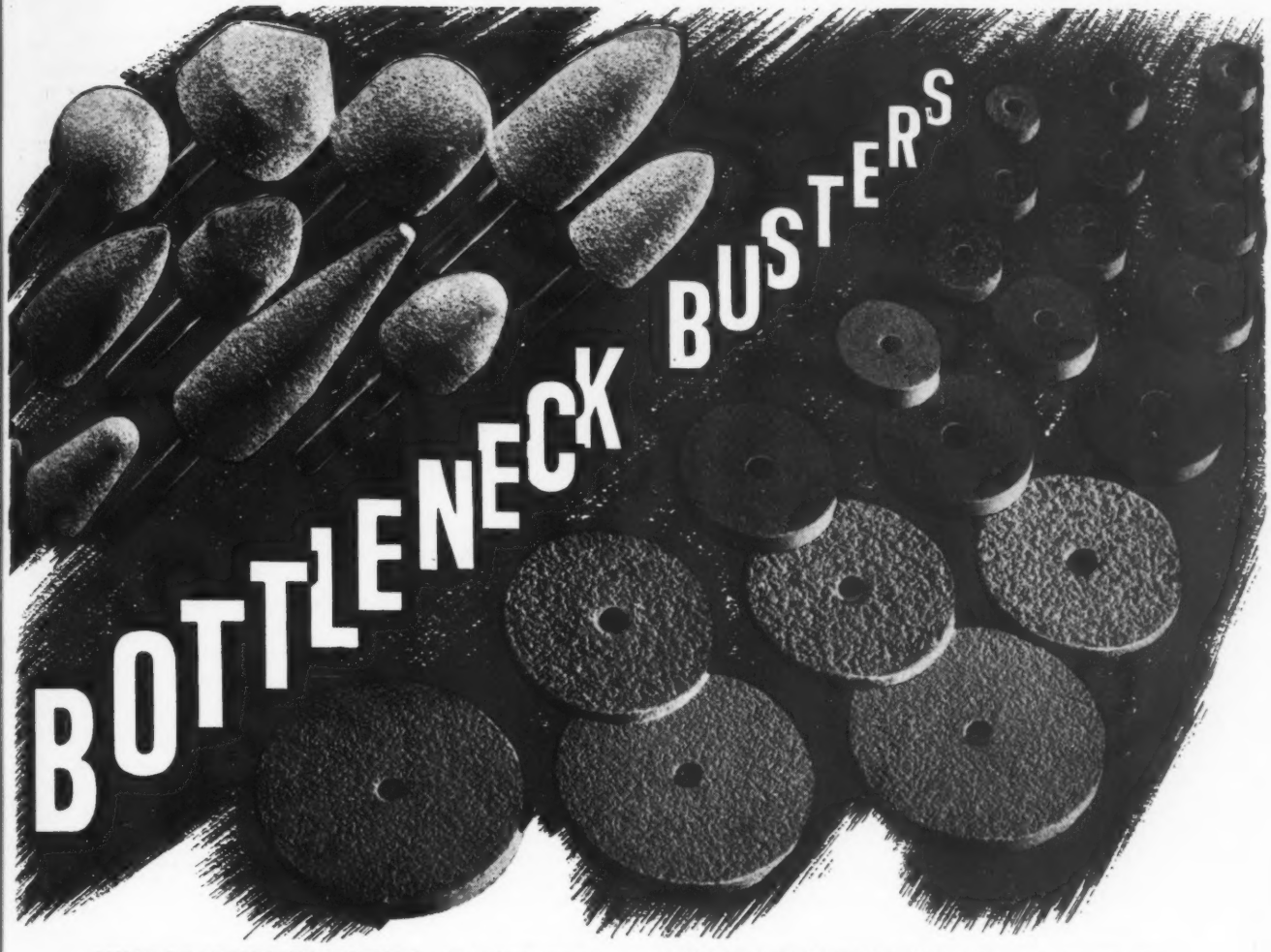
The new tension wrench, shown in the lower view, is available for use in production lines where uniform torque tightening of nuts, bolts, and tubing fittings is required. Each wrench is set at a given torque, which cannot be changed except by the man in charge of the tool-crib. The wrench indicates when the proper torque is attained by snapping open to the position shown in the illustration. When the load is released, the wrench snaps back to the neutral or normal position. A special adapter can also be used for tightening wing-nuts for hose clamps.

These tension wrenches are made in various sizes with torque settings to suit the requirements of the customer. 71

Identification Marking Fluid

Identification marking fluid is now being made by the Dayton Rogers Mfg. Co., 2835 Twelfth Ave., South, Minneapolis 7, Minn., in twelve distinct colors for marking alloy sheet strips and bars according to the manufacturer's own stock-room code system. This compound can be used to advantage

To obtain additional information on equipment described on this page, see lower part of page 182.



CHICAGO MOUNTED WHEELS—The first small wheels ever mounted on stationary shanks, they have maintained their supremacy through the years. Over 300 sizes, styles and grains—one to suit every job. They're tough, long lived, dependable.

CHICAGO GRINDING WHEELS—To break production bottlenecks due to the crying need for small wheels, we gave up making all larger sizes for the duration—with full WPB approval—and now specialize on sizes 3″ in diameter and under.

America's Unbeatables

Yes, all the wheels in our line are small, but powerful and *swift tools of war* doing their stuff day in and day out — making it possible to speed through everything that requires precision internal or external grinding, polishing and burring — bombsights, planes, tanks, guns, intricate instruments, etc.

PROMPT DELIVERY—Come to America's Headquarters for Small Wheels, custom built to your order. No waiting for shipments now, and after the war a reliable source of supply. Our central location is another asset—cuts shipping time to most plants.

Send the Coupon for Illustrated Catalog

CHICAGO WHEEL & MFG. CO.

1101 W. Monroe St., Dept. MR Chicago 7, Ill.

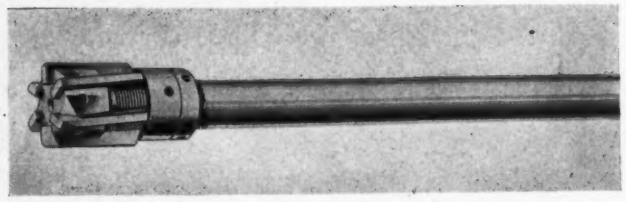
TEST WHEEL FREE—

So that you will know what Chicago Wheels can do, we'll gladly send one without charge. Tell us material you want to grind and size wheel you'd like.

• *Half a century of specialization has established our reputation as the Small Wheel People of the Abrasive Industry.*

for lay-out or inspection work and the identification of metal parts.

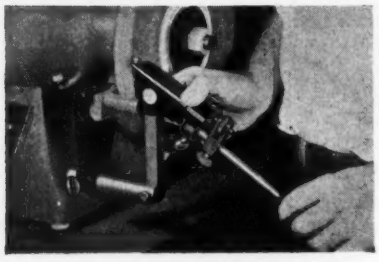
The use of this identification fluid does not require polishing or finishing of the material to be marked. When simply brushed on, it dries instantly. The material can also be used to apply part numbers or other identifying marks to various finished hardened and ground parts. A remover fluid obliterates part numbers and other identification marks no longer needed. Handy combination brush-in-cover containers for shop use, together with ink pads and pens, are furnished with this marking fluid. 72



Wetmore Adjustable Inserted-blade Reamer

inserted blades, is announced to the trade by the Wetmore Reamer Co., 418 N. 27th St., Milwaukee 8, Wis. The adjustable inserted blade is designed to make possible the maintenance of new tool efficiency, with a consequent saving in tool cost and greater accuracy of the work produced.

Type 36 is available in sizes for reaming holes from 5/8 to 31/32 inch in diameter, and Type 11 takes care of sizes from 1 to 3 inches in diameter. These reamers are available with either straight or tapered shanks. A Type 7 shell reamer is made in sizes for reaming holes from 1 1/4 to 6 inches in diameter, inclusive. 74



Twist Drill Grinding Fixture

Ind-L-Way Drill Grinding Fixture

The Industrial Engineering Co., Inc., 141 W. Jackson Blvd., Chicago, Ill., has brought out a line of Ind-L-Way twist drill grinding fixtures that can be adjusted for grinding the drill point to any angle from 30 to 90 degrees. These fixtures are designed to assure accurate grinding of drills of any size from A-1/4 inch to 2 7/8 inches. The fixture shown in the illustration is the smallest of this new line. It handles drills from A-1/4 inch to 3/4 inch.

Brackets for the grinding fixtures are designed for Black & Decker and Van Dorn bench or pedestal type grinders. Diagrams for use in making special brackets to adapt the fixtures for grinders of other makes are available. 73

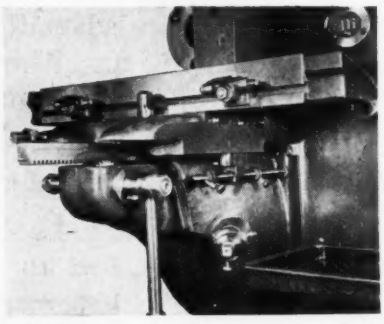
Wetmore Reamers

A new line of reamers, including types for left- and right-hand cutting, with high-speed steel, cast-alloy, or tungsten-carbide tipped

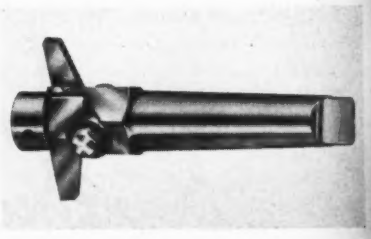
Lever-Actuated Transverse Feed for Nichols Miller

A rack-and-pinion transverse feed for application to Nichols milling machines is being placed on the market by the Nichols-Morris Corporation, 50 Church St., New York City, sole distributor for this new equipment. This feeding arrangement can be substituted for the regular transverse feed-screw to give greater flexibility of operation. It provides a means of obtaining rapid transverse table travel that has been thoroughly tried and proved successful on difficult production jobs, and should be of interest to all users of the high-precision Nichols milling machine manufactured by W. H. Nichols & Sons, Waltham, Mass. The latter milling machine is the successor to the well-known Whitney miller.

The main advantage of the rack-and-lever transverse feed is that it gives to the milling machine table and saddle the same flexibility of movement available in the conventional lathe carriage and cross-slide. As in a lathe, work can be chucked on the spindle with the tools mounted on the table, or vice versa. This feature of rapid transverse motion, combined with high spindle speeds and carbide-tipped tools, makes it possible to use the Nichols miller for boring, facing, counterboring, turning, profiling, and recessing operations which are usually assigned to precision boring machines and toolmakers' lathes. Close tolerances can be held on repetitive-operation work by means of adjustable stops. For extremely accurate work, dial indicators can be mounted on conveniently located finished surfaces. 75



Nichols Miller with Chip Guard Removed to Show New Transverse Feeding Equipment

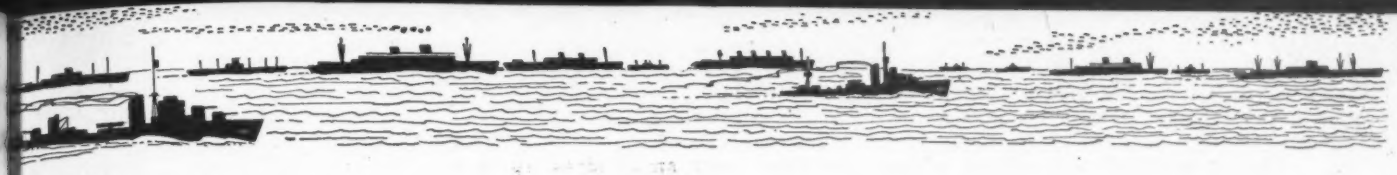


Clark Adjustable Counterboring and Spot-facing Tool

Clark Adjustable Counterboring and Spot-Facing Tools

The Robert H. Clark Co., 3424 Sunset Blvd., Los Angeles 26, Calif., has placed on the market a new adjustable counterboring and spot-facing tool. This new tool differs from conventional adjustable tools in that instead of a group of "fixed-diameter bits" that are interchangeable on a standard shank, it has blades that are themselves adjustable. The eight sizes of this counterbore and spot-facer cover all fractional and decimal diameters from 9/16 inch to 5 1/2 inches.

To obtain additional information on equipment described on this page, see lower part of page 182.



TOO MUCH, TOO SOON

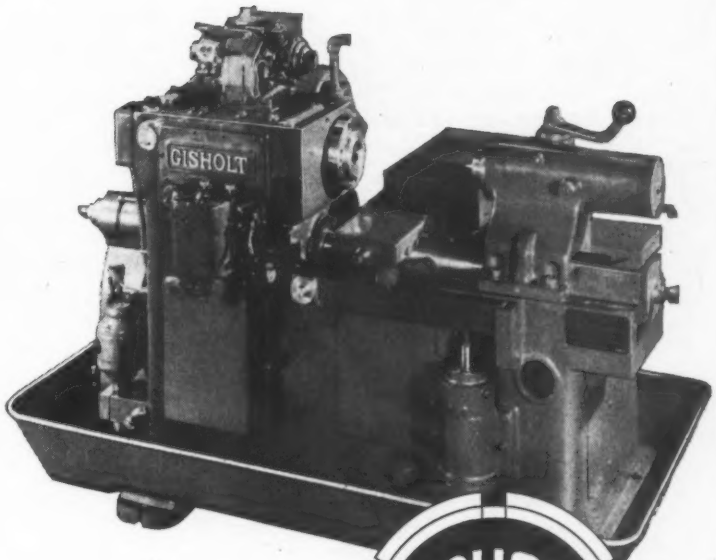
FOR THE AXIS!

In only four short years, the American machine tool industry has built more tools than were produced in the previous forty. They're better tools, faster, more accurate, easier to operate.

Today, they're all working in essential war industries. They're winning the battle of machines against machines. You may be confident that they're helping America create an irresistible striking power that our enemies will never match.

GISHOLT MACHINE COMPANY
1209 East Washington Avenue • Madison, Wisconsin

Look Ahead . . . Keep Ahead . . .
With Gisholt Improvements in Metal Turning



GISHOLT

THE GISHOLT AUTOMATIC HYDRAULIC LATHE requires so little attention that one man (or woman) can tend two or three machines. Easy tool set-up and adaptability to handle a variety of work, make it practical to use its high machining speeds even in small lot production.

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

The interchangeable pilots range from 3/16 inch to 5 1/4 inches in diameter.

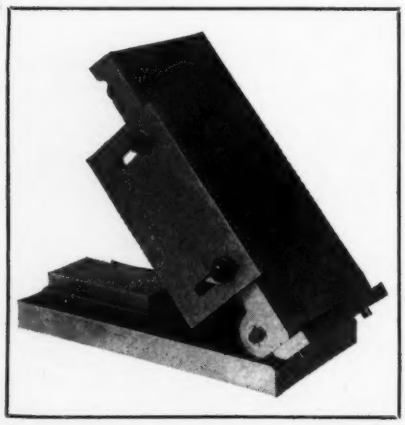
The cutting blades can be easily removed for sharpening or replacement. No special training or equipment is required for regrinding the blades to factory specifications. The interchangeable pilots are designed to prevent burrs from forming at the edge of the pilot hole, thereby avoiding locking or "freezing" of the pilots and resulting damage to the tool and work.

The tool is equipped with Tantung blades for machining all kinds of rolled, forged, or cast steel, iron, aluminum, brass, copper, bronze, and some hard materials formerly considered non-machinable with steel tools. In addition to performing counterboring or spot-facing operations, holes up to 5 1/2 inches in diameter can be bored to any depth without using fixed-size drills, except for drilling the first or pilot hole. The tools can be used in engine lathes, milling machines, drill presses, turret lathes, jig borers, boring mills, automatic screw machines, or any spindle type machine in which a boring-bar can be employed. 76

Carruth Sine Plate for Precision Inspection Work

A sine plate designed to facilitate the accurate checking of angular measurements in the inspection of tools and parts has been placed on the market by the Carruth Sales Co., 704 Boulevard Bldg., Detroit, Mich. The instrument is adapted for measuring the included angles of tools or production parts ranging from very small sizes up to 6 by 10 inches.

The desired angle between the stationary locating plate and the cylindrical gage bar on the movable block is obtained by using gage-blocks. The movable block is provided with 54 tapped holes 3/8 inch in diameter to facilitate clamping the work to be inspected. The block is also equipped with two guide plates, one at the end and another for use on either side. 77



Carruth Sine Plate for Checking Angles on Precision Work

Emergency Truing Tool for Grinding Wheels

Diamond chips or stones rejected by the diamond setter as being too small or otherwise unsuitable for resetting as single-point grinding wheel truing tools can now be used effectively for wheel truing in the "War Emergency" shank developed by the Cleveland Industrial Tool Corporation, 4713 Euclid Ave., Cleveland, Ohio.

The accumulations of rejected diamonds and chips from stones that may have cost as high as $50 per carat are generally sold for a very small fraction of their original cost to be ground up for use as diamond lapping dust. Hence, the new "Emergency" shank using about three carats of rejected diamonds represents a great saving in truing tool costs. The three-carat load of diamond rejections is held securely by a matrix, which as it peels away when in contact with the grinding wheel, continuously exposes new diamond faces to the wheel without loading the wheel face. 78

Century General-Purpose Protected Motor

A line of Form J general-purpose motors in a new protected design, in sizes from 1 1/2 to 15 H.P., is being brought out by the Century Electric Co., 1806 Pine St., St. Louis 3, Mo. These motors have the upper half of the end bracket closed in order to minimize the possibility of dripping liquids or falling objects entering the vital parts of the motor.

Two powerful fans located in back of the bearing brackets draw cooling air through openings around the bearings, across the windings, and through the air passages between the outer surfaces of the magnetic core and the frame, the heated air being expelled through openings at the side and bottom of the frame. 79

Century Protected Type Motor

"Hydromite" Cutting Lubricant

The Filmite Oil Corporation, Station K, Milwaukee, Wis., has brought out a cutting lubricant, designated "Hydromite," that embodies a new theory in cutting tool lubrication. It is a transparent and practically colorless water solution, yet it serves as an effective lubricant and is claimed to increase production and prolong the life of tools by its improved cooling and lubricating properties.

Its rapid heat-dissipating properties permit the use of higher cutting speeds. The low viscosity of the lubricant permits it to reach the point where its lubricating and cooling properties are most effective. The correct solution for the individual job is obtained by merely adding the required amount of water to the concentrated "Hydromite." The lubricant does not smoke during the cutting operation, can be easily removed from the finished work, drains well from chips, and has no unpleasant odor. 80

* * *

Gyroscopes are used in many types of war equipment. In one case, a gyro flywheel must be brought to full speed (12,000 R.P.M.) in 0.2 second. The Westinghouse motor that accomplishes this is about the size and shape of a beer bottle; and while weighing only 10 1/2 pounds, it develops 22 H.P.

High-Speed Milling Tests

At the annual meeting of the American Society of Mechanical Engineers, B. P. Graves, director of design of the Brown & Sharpe Mfg. Co., Providence, R. I., presented some interesting results obtained in high-speed milling tests.

In one instance, No. 14 S.T. aluminum forgings were milled with cutters 8 inches in diameter having four carbide-tipped teeth. These cutters were operated at 6280 surface feet per minute, with a feed of 60 inches per minute, or 0.005 inch per tooth. A 40-H.P. motor was used for driving the machine.

The experiments indicated that the full cutting capacity of the carbide teeth had not been reached, and both higher speeds and feeds would have been possible, provided increased power were applied to the machine.

In another test, S A E 4130 steel castings were milled. In this case, the cutters were 4 inches in diameter with four teeth provided with Firthite TA tips. The cutter tips had a negative spiral angle of 10 degrees and a 5-degree negative rake. The cutters were operated at a speed of 850 R.P.M., with a feed of 14 inches per minute. With this set-up, 150 pieces were produced per sharpening. On the same castings, other facing operations were performed at speeds varying from 850 to 1000 R.P.M., with feeds of from 11 to 22 inches per minute.

In another instance, steel forgings were milled with cutters ranging from 1 1/2 to 4 inches in diameter, having two teeth each. The teeth were resharpened stock Carboloy Grade 78B tipped tools, 3/8 to 1/2 inch square, and held in the cutter body by means of set-screws. The angle of spiral and the rake angle were both zero, these angles having been adopted because of the simplicity of grinding and also because they seemed to give as much satisfaction as negative angles.

The cutting speeds ranged from 300 to 500 feet per minute, although some of the experiments were conducted with speeds as high as 1600 feet per minute. The feeds ranged from 4 to 20 inches per minute. In this case, a production of from 30 to 40 pieces per sharpening was obtained, which was not considered particularly high.

Tests have also been conducted to determine the power used by the spindle motor when carbide cutters are used. A 2-inch diameter cutter having two teeth, placed in straight and radial positions, was operated at 850 R.P.M., with an 11 1/4-inch feed per minute and a 0.0066-inch feed per tooth. The material was S A E 1010 steel, and the cut taken was 15/16 inch wide. With a depth of cut of 0.2 inch, the net horsepower required for cutting was 1.2 (in addition to the 0.4 horsepower required to run the machine idle).

Tests were also made under the same general conditions, using a cutter 4 inches in diameter with two teeth. The cutting speed was 510 R.P.M., and the feed 7 inches per minute, or 0.0069 inch per tooth. The cut was 2 3/4 inches wide. With a depth of cut of 0.2 inch, the net horsepower required for cutting was 2.21.

A quantity of S A E 1010 plates, 24 7/16 inches long and 1 inch thick, were placed on edge for milling a surface 3 inches wide. A face milling cutter 4 inches in diameter was provided with two Carboloy 78B blades to cut approximately 7/32 inch deep with a feed per tooth of 0.007 inch. In producing 54 plates by taking eighteen cuts—three plates per cut—the actual cutting time was approximately 52 minutes. At the end of the run, the cutter was dull and needed resharpening, but there were no broken teeth. This face milling operation gave a considerably increased production over former milling operation results. It also resulted in a further saving in that the finish now secured is much improved; in fact, so much so that it has been found possible to eliminate a grinding operation after milling.

Another operation consisted of milling a bar of S A E 1020 steel, 4 inches wide by 6 inches long. This was milled on the face by means of a single-blade carbide tool at a speed of 550 R.P.M. and a feed of 5 11/16 inches per minute (or 0.010 inch per tooth), with a depth of cut of 1/4 inch. This cutter was 8 inches in diameter and had a 10-degree negative spiral angle and a 5-degree negative rake. The power requirement was 7 K.W.

Who Should Save Paper?

Paper saving should begin with the Government. According to a survey made by representative Bennett, of Missouri, the United States Government issues some 441 publications. It is safe to say that the majority of these are unnecessary as Government activities. Why the Government should be so extensively in the publishing business is difficult to understand. It seems that every Government agency thinks it is necessary to issue a publication.

According to Mr. Bennett, the Government is publishing 9 dailies, 48 weeklies, 12 semi-monthlies, and 241 monthly magazines or papers, which is only a partial list. The sole purpose of many of these papers, Mr. Bennett charges, is to "advertise the agency which puts them out and to drum up public and Congressional support for a continuation of the respective agency's particular brand of alphabetical bureaucracy." It is indefensible for the Government to waste paper on many of these publications at a time when private publishers are ordered to drastically reduce the use of paper in publications, many of which are a direct part of the war effort, like the engineering publications that deal wholly with production problems.

The Department of Agriculture and the Department of Commerce each bring out some 80 publications. Mr. Bennett's survey credits the Labor Department with about 30 publications; but other publications on labor are put out by the Federal Security Agency and the Federal Works Agency. There are many duplications in other fields. According to the survey, the Department of Agriculture has publications devoted to wheat, wool, fats, and oils. The Department of Commerce also brings out publications on these subjects.

Let us remember that all of these periodicals are published by the taxpayers' money. It is impossible to determine how many thousands of men and women are employed in putting out these publications. They require a great many editors, writers, stenographers, and other employes, who are on the Federal payroll and help to swell the amount that all of us have to pay in taxes.

back of them ...

the shadow of GEARS

THERE is no substitute for "soup" any airman will tell you—"soup," the concentrated energy that giant Pratt & Whitney engines develop to speed the mighty Hellcat on its missions of destruction.

And back of these planes—back of the giant 2,000 horsepower engines that power them are gears. Gears of such extreme precision—held to such close tolerances—that each one is a modern marvel of engineering and manufacturing perfection.

Foote Bros. take pride in the production techniques that make such high precision possible—pride in the manufacturing "know-hows" that are responsible for the tremendous quantities of these gears rolling off production lines in three of its huge plants.

And Foote Bros. are looking ahead to the day when these precision gears will mean a new approach in the economical transmission of power in peacetime machines. Already on the drafting boards of many manufacturing plants are machine tools and construction equipment—combustion engines and other machinery that promise new efficiencies because of the precision gears they will employ.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 S. Western Blvd. • Chicago 9, Illinois

FOOTE BROS.

Better Power Transmission Through Better Gears

What Has Standardization Accomplished?

In mass production, what is the real secret of success, both as regards quantity and quality of output? Of course, many factors contribute, but back of them all is standardization—the adoption of standards for interchangeable parts that can all be made alike with the best and most rapid methods.

In many industries, standardization has aided tremendously in making high production possible, as compared with former output. MACHINERY would like to place on record some outstanding examples where increased production or marked cost reduction may be directly attributed to standardization. Statements of this character need only mention the parts standardized and manufactured, and the increase in output or the reduction in manufacturing costs obtained through standardization, as compared with former output or costs.

Recent Army-Navy "E" Production Awards

The following companies have recently received the Army-Navy "E" Production Award or a renewal of the Award:

Charles H. Besly & Co., Beloit, Wis.

Blackhawk Mfg. Co., Milwaukee, Wis.

Independent Pneumatic Tool Co., Aurora, Ill. (renewal)

R. Krasberg & Sons Mfg. Co., Chicago, Ill. (renewal)

Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J.

Pollak Mfg. Co., Arlington, N. J. (renewal)

Simmons Machine Tool Corporation, Albany, N. Y. (renewal)

Standard Steel Works Division of the Baldwin Locomotive Works, Philadelphia, Pa. (renewal)

Yale & Towne Mfg. Co., Philadelphia, Pa.

York Corporation, York, Pa.

Thickness of Silver-Brazed Joints

In using ordinary soft solders and regular base-metal brazing alloys, V-shaped joints of considerable thickness are often required. When brazing alloys containing substantial proportions of silver are used, it has been found that the maximum strength is obtained when the clearance space that is filled with the brazing alloy is only a few thousandths of an inch. In some tests made in brazing stainless steel, as reported by the American Silver Producers' Research Project, it was found that the maximum strength was obtained with a joint 0.0015 inch thick.

Because of their fluidity, silver brazing alloys penetrate into narrow spaces; and if the joint is properly designed, it is usually as strong as the metals being brazed. The small amount of silver alloy required offsets the cost of the silver employed.

Finish-boring Blade Grooves in a Low-pressure Turbine Cylinder Blade Ring on a Betts 100-inch Vertical Boring Mill at the Westinghouse Merchant Marine Turbine and Gear Plant. The Tolerance on the Width of the Grooves is 0.001 Inch

Know your KENNAMETAL!

5 standard grades of KENNAMETAL now serve the needs of the metal-cutting industries. Note their main individual characteristics and specific applications.

KM

Rockwell 90.8 A—Strongest crater resistant grade, for roughing cuts on carbon and alloy forgings, bar stock, tubing, etc., with carbon content of .30% and above.

K3H

Rockwell 91.8 A—Harder than KM but not as strong. K3H, the most crater resistant grade, is recommended for finishing or moderate cuts on carbon and alloy steels .30% carbon and above, and also for general use on soft steels containing less than .30% carbon. Used widely for milling of steels.

K4H

Rockwell 92.3 A—More resistant to edge wear than K3H but not as crater resitant. For precision boring and light finishing cuts on all steels. Very good for tools requiring large nose radius or where tool must dwell without cutting. Used wideiy for milling and extremely rough cutting of non-ferrous and non-metallic materials.

K2S

Rockwell 91.5 A—A strong grade better able to withstand abrasion and sand inclusions than KM, but not as crater resistant. For roughing steel castings and for very rough cuts on cast iron.

K6

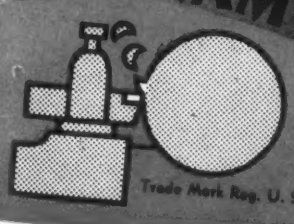
Rockwell 92.1 A—A straight Tungsten Carbide grade, more abrasion resistant than K4H, but with less impact resistance. For general use on cast iron, non-ferrous and non-metallics.

Check the material you wish to machine against the above characteristics—single out the grade that fits your purpose—choose Kennametal tools in styles appropriate for specific operations (our Catalog 43-C will guide you). Then you will be assured the most satisfactory results—in character of work—in volume of production—in length of tool service.

KENNAMETAL *Inc.*

147 LLOYD AVE., LATROBE, PA.

KENNAMETAL



Trade Mark Reg. U. S. Pat. Off.

SUPERIOR CEMENTED CARBIDES

Method of Securing Thin Gear to End of Shouldered Shaft

By L. KASPER

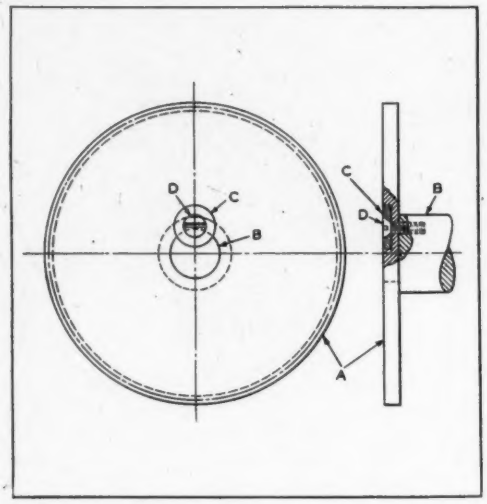


Diagram Showing Method of Using Driving Disk in Place of Key to Secure Thin Gear to Shouldered End of Shaft

The fine-pitch gear with a narrow face shown at *A*, when mounted on the shouldered end of a shaft *B*, frequently became loose on its key, and caused considerable trouble due to backlash. This trouble was eliminated by replacing the conventional key with the driving washer *C*.

To apply the washer driving arrangement, a hole is first drilled and tapped in gear *A* and shaft *B* at the periphery of the shoulder on the shaft, so that one half of the drilled hole is in the shaft and the other half in the gear. This hole is then counterbored partly through gear *A* to a press fit for washer *C*. Screw *D* acts as a retainer.

Film on Thermit Welding

A 16-millimeter color and sound film showing the fabrication of ship stern frames by Thermit welding has recently been produced by the Metal & Thermit Corporation, 120 Broadway, New York City. The film, which requires about twenty-five minutes to run off, shows all of the steps in the construction of a stern frame, from the time the castings are received at the shipyard until the finished frame is installed in the ship. The film is available for showing before technical groups and associations interested in shipbuilding and welding procedure.

* * *

Gear Production Continues to Increase

The American Gear Manufacturers Association reports that the gearing industry shows an increase of 15 per cent in the business booked in October (the last month for which complete statistics are available) compared with September. This report does not include turbine or propulsion gearing.

Lenses for Welders

"Noviweld-Didymium" lenses for flame welders are now available in what is known as the No. 3 shade, which is particularly useful for welders working on aluminum. These lenses are made by the American Optical Co., Southbridge, Mass. It is stated that they are made from a glass that enables flame welders to see the working areas more clearly; in addition, the glass protects the eyes against both ultra-violet and infra-red radiation. The lenses preserve orange and red color values, so that the welders can see the red-hot bead and the molten metal in brilliant colors.

* * *

"Sinszine" as an Aid in Drilling Glass

A product known as "Sinszine," made by E. Karelsen, Inc., 125 W. 45th St., New York City, designer and producer of diamond cutting tools, is stated to aid in the rapid, smooth drilling of glass by lubricating the drilling operation. The new lubricant also promotes greater life of the tool.

Sweet's File for Product Designers

Design engineers and research specialists will be interested in the announcement of a new publication entitled "Sweet's File for Product Designers," which is published by Sweet's Catalog Service, 119 W. 40th St., New York City. The new service was inaugurated to meet the needs of men who select and specify materials, finishes, and component parts for incorporation in their companies' products. The first issue contains essential information on the products and services of 195 companies whose catalogues included in this publication total 1540 pages.

The book is divided into five parts dealing respectively with materials; finishes; parts; techniques; and work equipment.

* * *

Electric Eye in Inspection Work

Electronic inspection devices are being used to an ever increasing extent in industry. The Electric Eye Equipment Co., Danville, Ill., has developed inspection equipment that is being used in many war production plants. Such equipment provides automatic inspection to tolerances as small as plus or minus 0.0001 inch. In one ordnance plant, electric eye inspection machines make seven simultaneous dimensional inspections at the rate of 93 pieces per minute.

* * *

American Standard for Pipe Plugs, Bushings, and Caps

A new American standard has just been approved that brings together the various standards covering pipe plugs, pipe bushings, pipe caps, and lock-nuts used in piping systems. The new combined standard is known as "American Standard for Ferrous Plugs, Bushings, Lock-nuts, and Caps with Pipe Threads (B16.14-1943)." It is obtainable at 40 cents per copy from the American Standards Association, 29 W. 39th St., New York 18, N. Y.

We would really like to know the answer ourselves. The facts in the case are that Genesee today is one of the Nation's major producers of Dovetail tools just as it is among the leaders in the production of many other types of special tools.

It may have something to do with jealous maintenance of quality—though we know other companies make good tools too. It may have something to do with deliveries—though we haven't been too happy at times in the past when we looked at our banks of unfilled orders. Somehow "price" can't be the answer, for we have never sacrificed quality for the sake of price.

Perhaps it's just a combination of all of them. If you know, won't you tell us?

We welcome your comments and inquiries.

GENESEE TOOL COMPANY

FENTON, MICHIGAN

★ Registered Trade Mark

News of the Industry

California

R. D. ULREY has been appointed manager of the new Los Angeles, Calif., office of the Joshua Hendy Iron Works, Crocker-Wheeler Electric Division. The new office is located in the Pacific Mutual Building, 523 W. Sixth St., Los Angeles.

GENERAL PACIFIC CORPORATION, 1800 S. Hooper Ave., Los Angeles 21, Calif., has acquired the manufacturing and sales rights to the "Hydra-Drill," an automatic adjustable power feed for drill presses, which was formerly manufactured by the L. B. Mfg. Co., Los Angeles, Calif.

J. F. BECHTLE has joined the Standard Steel Corporation, Los Angeles, Calif., as assistant general manager. Mr. Bechtle was connected for twenty years with the M. W. Kellogg Co. of New York in the metallurgical and research departments.

Illinois and Indiana

FRANK H. FISHER has been appointed manager of the Welding and Cutting Division of the Bastian-Blessing Co., 4203 Peterson Ave., Chicago, Ill. He will supervise promotional and sales work of the company's Rego line of welding and cutting products. Mr. Fisher was previously associated with the American Steel Foundries, also of Chicago.

J. A. PROVEN has been appointed general sales manager of the Sterling Tool Products Co., Chicago, Ill. He was formerly connected with the Victor Adding Machine Co. at Los Angeles.

CHARLES M. BURGESS, president of the Burgess-Norton Co., Geneva, Ill., has been appointed one of the five members of the Higher Education Survey Commission created by the Illinois State Legislature.

OTTO E. ZAHN has been appointed assistant works manager of the American Foundry Equipment Co., Mishawaka, Ind. Since joining the company in 1937 he has held the positions of development engineer and acting general superintendent.

INTERNATIONAL MACHINE TOOL CORPORATION, Elkhart, Ind., announces that the DETROLA CORPORATION, of Detroit, Mich., manufacturer of radios and electronic devices, has been merged with the company.

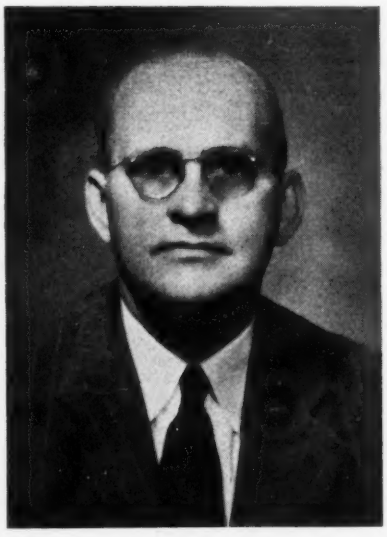
Michigan

GENESEE TOOL CO., Fenton, Mich., producer of Tomahawk cutting tools, announces the addition of the following factory service and sales district offices: 710 Harries Bldg., Dayton, Ohio; Penton Bldg., Cleveland, Ohio; 601 Tower Bldg., South Bend, Ind.; 1506 Toledo Trust Bldg., Toledo, Ohio; 1217 Grant Bldg., Pittsburgh, Pa.; and 1109 Fletcher Trust Bldg., Indianapolis, Ind. H. E. ROEDTER is the Dayton district manager; GEORGE PIERCE, manager at Cleveland; T. S. MELLEN, South Bend manager; W. F. HAVERSTOCK and M. TEAGUE, heads of Toledo office; and J. ARMSTRONG, Indianapolis manager.

DETROIT TAP & TOOL CO., Detroit, Mich., manufacturer of thread production tools and machinery, announces the opening of new offices at 1409 Union Central Bldg., Cincinnati, Ohio, with E. W. BROCK as district manager; 601 Tower Bldg., South Bend, Ind., with T. S. MELLEN in charge; 1109 Fletcher Trust Bldg., Indianapolis, Ind., J. R. ARMSTRONG manager; and 1217 Grant Bldg., Pittsburgh, Pa., A. OLSON manager.

AMERICAN SCREW CO., Detroit, Mich., has moved its offices from the General Motors Bldg. to the Stephenson Bldg., Room 502.

J. ALLAN MACHIN has been appointed general sales manager of W. O. Barnes Co., Inc., Detroit, Mich. He was formerly associated with Alexander Bros., of Philadelphia.



J. Allan Machin, General Sales Manager of W. O. Barnes Co.

WELKER MACHINERY CO., INC., Detroit, Mich., has been appointed special distributor for the Tocco process induction equipment produced by the Ohio Crankshaft Co., Cleveland 1, Ohio.

New England

W. EARLE SHUMWAY has been appointed sales manager of the western region by the Norton Co., Worcester, Mass., succeeding R. M. JOHNSON, who was recently appointed general sales manager. Mr. Shumway's territory will extend from east of the Mississippi River to the West Coast, including the Norton Detroit and Chicago warehouse districts. He has been connected with the Norton Co. since 1917, when he entered the research laboratories of the company. Since 1932, he has been manager of the Chicago warehouse and sales territories. The Norton Cleveland warehouse and sales district has been transferred from the western region to the eastern region, where it comes under GEORGE A. PARK, sales manager of the eastern region. Mr. Park and Mr. Shumway will have their headquarters at Worcester. RAYMOND E. TAYLOR has been appointed Chicago district manager, succeeding Mr. Shumway. Since 1938 Mr. Taylor has held the position of business research manager.

FRANK W. WARNER has been named successor to HENRY M. RICHARDSON as chief engineer of the Plastics Division of the General Electric Co. at Pittsfield, Mass. He has been connected with this division since 1931, and previous to assuming his present position, was in charge of engineering development.

FRANK W. COPP has been elected vice-president of the Lynd-Farquhar Co., Boston, Mass. He has been connected with the company since 1930 as a field service engineer.

BENJAMIN J. LAZAN, chief engineer of the Sonntag Scientific Corporation, Greenwich, Conn., an affiliate of the Baldwin Locomotive Works, was recently awarded the 1943 Alfred Noble Prize for outstanding research work represented by his paper on "Some Mechanical Properties of Plastics and Metals Under Sustained Vibrations." The presentation was made at the annual dinner of the American Society of Mechanical Engineers in New York early in December. Mr. Lazan is only twenty-six years old.

MOMENT OF INERTIA, ETC., FOR STANDARD-WEIGHT STRUCTURAL CHANNELS—3

Values of Moment of Inertia *I*, Section Modulus *S*, and Radius of Gyration *r* for Two Channels Placed Back to Back at Varying Distances Apart

Size, Inches	Weight of One Channel, Pounds	Area of Two Channels, Square Inches	Flange Width, Inches	Factor	Distance Apart *B*, Inches										
					7/8	15/16	1	1 1/4	1 1/2	1 3/4	2	3	4	5	6
					Values of *I*, *S*, and *r*										
3	4.1	2.38	1.41	I	2.24	**2.37**	2.50	3.08	3.78	4.50	5.32	9.32	....	....	....
				S	1.22	1.27	1.31	1.52	1.75	1.97	2.21	3.20	....	....	....
				r	0.972	0.997	1.025	1.14	1.26	1.375	1.495	1.98	....	....	....
4	5.4	3.12	1.58	I	3.14	3.34	3.52	4.30	5.20	6.20	7.30	12.68	19.40	....	....
				S	1.56	1.63	1.69	1.94	2.23	2.53	2.83	4.12	5.42	....	....
				r	1.00	1.035	1.06	1.17	1.29	1.41	1.53	2.01	2.50	....	....
5	6.7	3.90	1.75	I	4.32	4.54	4.78	5.80	6.96	8.20	9.62	16.40	25.16	35.86	....
				S	1.97	2.06	2.13	2.44	2.79	3.13	3.50	5.04	6.72	8.45	....
				r	1.06	1.08	1.11	1.22	1.34	1.45	1.57	2.05	2.54	3.03	....
6	8.2	4.78	1.92	I	5.70	6.08	6.26	7.72	9.10	10.76	12.50	20.92	31.60	44.40	60.60
				S	2.42	2.54	2.64	3.03	3.51	3.88	4.28	6.13	8.06	10.10	12.35
				r	1.09	1.126	1.145	1.265	1.38	1.50	1.62	2.09	2.57	3.05	3.56
7	9.8	5.70	2.09	I	7.42	7.66	8.10	9.86	11.60	13.56	15.62	25.80	38.90	54.80	73.60
				S	2.93	3.00	3.13	3.63	4.08	4.57	5.06	7.18	9.50	11.96	14.45
				r	1.14	1.16	1.192	1.312	1.42	1.545	1.652	2.12	2.62	3.10	3.60

Note: The radius of gyration with respect to axis 1–1 is equal to that with respect to axis 2–2 when *B* is 1.31 inches for 3-inch size channels; 2.06 inches for 4-inch size; 2.79 inches for 5-inch size; 3.52 inches for 6-inch size; 4.22 inches for 7-inch size; 4.94 inches for 8-inch size; 5.63 inches for 9-inch size; 6.33 inches for 10-inch size; 7.67 inches for 12-inch size; 9.50 inches for 15-inch size, and 11.27 inches for 18-inch size channels.

MACHINERY'S Data Sheet No. 505, January, 1944

Compiled by J. Lewis Luckenbach

MOMENT OF INERTIA, ETC., FOR STANDARD-WEIGHT STRUCTURAL CHANNELS—4

Values of Moment of Inertia *I*, Section Modulus *S*, and Radius of Gyration *r* for Two Channels Placed Back to Back at Varying Distances Apart

Size, Inches	Weight of One Channel, Pounds	Area of Two Channels, Square Inches	Flange Width, Inches	Factor	Distance Apart *B*, Inches										
					7/8	15/16	1	1 1/4	1 1/2	1 3/4	2	3	4	5	6
					Values of *I*, *S*, and *r*										
8	11.5	6.72	2.26	I	9.44	9.84	10.26	12.42	14.50	17.00	19.26	31.50	47.10	66.10	88.40
				S	3.51	3.62	3.73	4.31	4.82	5.42	5.90	8.38	11.10	13.90	16.80
				r	1.19	1.21	1.24	1.36	1.47	1.60	1.72	2.17	2.65	3.14	3.63
9	13.4	7.78	2.43	I	12.00	12.48	13.00	15.56	17.96	20.86	23.64	38.10	56.40	78.70	104.80
				S	4.20	4.32	4.45	5.08	5.65	6.32	6.90	9.68	12.70	15.90	19.30
				r	1.24	1.27	1.29	1.41	1.52	1.64	1.75	2.21	2.69	3.18	3.67
10	15.3	8.94	2.60	I	14.84	15.54	16.06	19.06	21.84	24.68	28.58	45.33	66.80	92.50	122.70
				S	4.90	5.09	5.20	5.90	6.53	7.08	7.95	10.82	14.52	18.15	21.90
				r	1.29	1.32	1.34	1.46	1.56	1.67	1.79	2.25	2.73	3.22	3.71
12	20.7	12.06	2.94	I	23.26	24.00	24.94	27.94	33.20	38.00	42.80	66.10	95.40	131.60	173.30
				S	6.91	7.06	7.26	7.82	9.00	9.95	11.20	14.90	19.30	24.20	29.20
				r	1.39	1.415	1.43	1.52	1.66	1.775	1.89	2.34	2.81	3.30	3.80
15	33.9	19.80	3.40	I	45.90	47.30	48.90	57.40	63.20	70.80	**80.20**	120.00	170.80	231.30	301.50
				S	12.00	12.25	12.52	14.25	15.25	16.55	18.20	24.50	31.62	39.10	47.20
				r	1.52	1.54	1.57	1.705	1.785	1.895	2.01	2.46	2.94	3.41	3.89
18	42.7	24.96	3.95	I	74.20	76.20	78.20	88.40	97.80	108.20	119.60	172.60	239.40	319.00	409.00
				S	16.90	17.30	17.60	19.30	20.80	22.40	24.20	31.70	40.30	49.40	59.00
				r	1.72	1.75	1.77	1.88	1.98	2.09	2.19	2.64	3.12	3.57	4.05

Note: For radii of gyration with respect to axis 1–1 equal to that with respect to axis 2–2, see note on Data Sheet No. 505.

MACHINERY'S Data Sheet No. 506, January, 1944

Compiled by J. Lewis Luckenbach

New York and New Jersey

AMERICAN CAR & FOUNDRY CO., 30 Church St., New York City, announces the following changes in its personnel: VICTOR R. WILLOUGHBY, vice-president formerly in charge of engineering, has been made director of research and development; EDMUND D. CAMPBELL, formerly general mechanical engineer, is now vice-president in charge of engineering, succeeding Mr. Willoughby; ALLEN W. CLARKE, formerly mechanical engineer in charge of the Western Engineering Division, has been appointed assistant general mechanical engineer, with headquarters at St. Charles, Mo. W. F. DIETRICHSON, formerly assistant general mechanical engineer at the Berwick, Pa., plant of the company, has been made general mechanical engineer, with headquarters at the same plant.

RUTAN & SNEAD, INC., 1 Hudson St., New York 13, N. Y., has been formed by HERBERT S. SNEAD, president, EVERETT J. RUTAN, vice-president, and HARRY W. DRYDEN, secretary, to act as industrial consultants for machine and product development and design; handle design work and consultation on mechanical, electrical, and electronic equipment; and advise on production and quality control and on plant and process improvements. The extensive and diversified experience of the members of the firm represents a combined total of seventy-five years in industry development work.

CARBORUNDUM CO., Niagara Falls, N. Y., announces the following changes in the personnel of its sales organization: E. R. BAXTER has been appointed assistant to the vice-president in charge of sales. CHARLES KNUPFER; JOHN F. CLAYDON, formerly a salesman in the Boston territory, has been appointed district sales manager at Boston, succeeding FRED W. BONACKER, who has been assigned to special sales work at the main office of the company; A. A. MURFEY has been appointed district sales manager at Cleveland.

AMERICAN MACHINE & FOUNDRY CO., 511 Fifth Ave., New York City, announces that the board of directors recently elected MOREHEAD PATTERSON chairman of the board, succeeding the late RUFUS L. PATTERSON. Mr. Patterson previously served as president, which position will now be filled by HERBERT H. LEONARD. For the last year, Mr. Leonard has been a member of the board of directors and engineering consultant to the company.

GREENE, TWEED & CO., Bronx Blvd. at 238th St., New York City, manufacturer of Palmetto and other self-lubricating mechanical packings, announces the purchase of the Asbestos Fibre Spinning Co., of North Wales, Pa. By this acquisition, Greene, Tweed & Co. will greatly enlarge its line of asbestos products.

T. R. RIDEOUT, who for many years has been associated with the Nuttall Works of the Westinghouse Electric & Mfg. Co. in various capacities in the gearing engineering department, is now connected with the Watson-Flagg Machine Co., Paterson, N. J., manufacturer of gearmotors and gear drives.

Ohio

DONALD S. KLIPPERT has been appointed assistant general manager of sales of the Steel and Tube Division of the Timken Roller Bearing Co., Canton 6, Ohio. He was formerly Cleveland district manager of that division. ROBERT P. DONNELL will succeed Mr. Klippert as Cleveland district manager. Mr. Donnell is a metallurgical engineer, and has been specializing in aircraft applications in the Steel and Tube Division for the last six years.

MEC-RAD DIVISION OF BLACK INDUSTRIES, 1400 E. 222nd St., Cleveland, Ohio, has recently been organized to manufacture the mechanical components of all types of radionic devices. JOHN ALTMAYER is chief engineer of the new division, and THEODORE R. FINKE is development and production engineer.

MICHIGAN TOOL CO., Detroit, Mich., manufacturer of gear production equipment, Cone-Drive gearing, and gear-cutting tools, announces the opening of a factory service and sales district office at 1506 Toledo Trust Bldg., Toledo 4, Ohio. M. E. TEAGUE and W. F. HAVERSTOCK will have charge of the new office.

COLONIAL BROACH CO., Detroit, Mich., announces the opening of an office at 710 Harries Bldg., Dayton, Ohio, with H. E. ROEDTER as district manager, as well as an office in the Penton Bldg., at Cleveland, Ohio, with GEORGE PIERCE as district manager.

A. H. HENRICK, formerly associated with Thompson Products, Inc., of Cleveland, Ohio, is now connected with the Auto-Diesel Piston Ring Co., of Cleveland, in the capacity of assistant to the vice-president and the general manager.

O. L. EARL has been appointed market development engineer in connection with post-war problems and planning for the Pressed Metal Institute, with headquarters at 829 Union Commerce Bldg., Cleveland 14, Ohio.

CINCINNATI CHAMBER OF COMMERCE, Cincinnati, Ohio, has brought out a transportation and industrial map of Cincinnati which will be furnished free of charge upon application to the Cincinnati Chamber of Commerce.

Pennsylvania

ARCHIE CHANDLER, vice-president of the American Pulley Co., Philadelphia, Pa., has retired from active sales management of the company. He will continue to hold the position of vice-president, but will return to his former home in San Francisco, where he will direct the company's sales and service on the West Coast. He has been with the company since 1915, and was located on the West Coast until 1928, when he went to Philadelphia to become general sales manager. FRANK E. BROWN, who has been assistant sales manager for fifteen years, will succeed Mr. Chandler as general sales manager.

G. J. STEGEMERTEN, staff supervisor of industrial methods engineering for the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., was recently appointed expert consultant to the Secretary of War. His duties in connection with the appointment will involve study of certain administrative functions in connection with the various arsenals and ordnance plants operated by the War Department. He has been with the Westinghouse organization since 1909. In 1926, he was placed in charge of the company's wage incentive activities.

W. H. STEINKAMP, assistant general sales manager of the Brown Instrument Co., Division of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa., addressed the Engineers Club at Detroit, Mich., November 19 on the practical aspects of automatic control. This is the first of a series of talks to be given by Mr. Steinkamp this winter before various engineering groups in different parts of the country and various groups of technical members of private companies.

THOMAS T. WATSON, who has been research metallurgist in charge of the research department of the Lukens Steel Co., Coatesville, Pa., since 1939 has been appointed director of research for the company and its subsidiaries, By-Products Steel Corporation and Lukenweld, Inc. D. BRUCE JOHNSTON has been made assistant to the director of research, and SAMUEL D. LEMMON, research metallurgist.

WILLIAM G. THEISINGER, who has been director of welding research for the Lukens Steel Co., Coatesville, Pa., since February, 1941, has been appointed assistant to the vice-president, D. S. WOLCOTT. Dr. Theisinger will assist Mr. Wolcott in work connected with the manufacture, sale, and application of special products.

WILLIAM BUTLER, 3RD, has recently been appointed advertising manager of the Lukens Steel Co., Coatesville, Pa., and its subsidiaries, succeeding GEORGE M. GILLEN, who has been made assistant manager of combined sales. Mr. Butler was formerly connected with the sales promotion department of the company.

QUAKER CHEMICAL PRODUCTS CORPORATION, Conshohocken, Pa., announces the following additions to its organization: STUART O. FIEDLER and WALTER A. STRZALKOWSKI have joined the research laboratory staff, and CHARLES F. BOYD has become a metal process engineer for the company in the St. Louis, Mo., area.

DOW CHEMICAL CO., Midland, Mich., has opened a new office at 1400 S. Penn Square, Philadelphia, Pa., with ALEXANDER LEITH, JR., in charge. Mr. Leith has been with the Dow organization's New York sales office since 1923. He graduated from Colgate University in 1919.

E. L. HUFF, formerly electrical engineer at the Brackenridge plant of the Allegheny Ludlum Steel Corporation, has been appointed chief engineer of all the plants of the corporation.

ROBERT BROWN has been appointed sales manager of the Ace Drill Corporation, Detroit, Mich., covering the eastern states, with headquarters in Philadelphia.

Wisconsin and Missouri

THOMAS F. SCANNELL has been appointed general sales manager of the Falk Corporation, Milwaukee, Wis., manufacturer of herringbone and helical gears, speed reducers, heavy drives, flexible couplings, and steel castings. Mr. Scannell was previously sales manager for all the products of the company except those of the Foundry Division, which now come under his jurisdiction. JOHN S. WILKINSON, who has been connected with the Falk foundry for many years, will serve as assistant sales manager in charge of foundry sales.

HARRY WEAVER has been appointed foundry engineer for the Brillion Iron Works, Inc., Brillion, Wis. He was for five years previously foundry engineer for the Caterpillar Tractor Co., Peoria, Ill.

ARTHUR SMITH, JR., has been named head of magnesium sales for the Dow Chemical Co., Midland, Mich., in the southwest territory, with headquarters at Second and Madison Sts., St. Louis, Mo. Mr. Smith has been connected with the company since 1937, and was formerly in the Magnesium Division at Chicago.

Renegotiation—A New Name for the Use of Arbitrary Power

In renegotiation procedures, industry has found how easily governmental agencies will assume arbitrary powers if not subject to supervision by the courts and to the time-honored accepted legal standards of the land. Referring to this subject, the Lincoln Electric Co. points out how far the present methods of renegotiation of contracts by the Government have departed from the original meaning of the word.

Originally, "renegotiation" implied that two free and equal persons who have freely negotiated in the past sit down amicably to negotiate it all over again. The Government at present, however, has made renegotiation mean just the opposite of this procedure, since an arbitrary power has been conferred upon a Government agency whose decisions cannot be passed upon by the courts.

Through so-called "renegotiation," it is possible for this agency to arbitrarily force a manufacturer to sell at prices less than those that have been considered reasonable for his product in the past; and actually, instead of saying "renegotiate," we should say that this is a method whereby the Government "refixes" the contract price. In other words, renegotiation becomes the power of the Federal Government to repudiate contracts without review of the courts.

The only practical limitation placed upon the Government agency is that it should set a price just high enough to permit the contractor to survive. Since the efficient producer with low costs does not need as high a price to survive as the inefficient producer, the Government sets the price at different levels for efficient and inefficient manufacturers. Surely, there must be a more satisfactory and equitable way for the Government to insure that no one should make exorbitant and undeserved profits out of war contracts.

Making the New Employe Feel at Home

The Walker-Turner Co., of Plainfield, N. J., makes it a practice to present its new employes with a little pamphlet entitled "Your Job," outlining the general policies of the concern as regards attendance, hours of work, vacations, promotions, compensation, activities of the labor-management committee, insurance, recreation, etc. The booklet is intended to make the new employe feel at home and understand the spirit of the organization. It is believed that a book of this kind helps to promote mutual understanding between the employes and the management.

* * *

Spotlight for Arc-Welding Operators

A new spotlight designed to provide glareless illumination of sufficient intensity so that an arc-welding operator can see his work distinctly through the dark lens of a welding helmet prior to striking the arc has been developed by the Electric Welding Division of the General Electric Co., Schenectady, N. Y. The new spotlight is especially intended for production-line welding, where the establishment of the arc must be made quickly and accurately, as in the welding of thin materials, light alloy castings, and aircraft parts.

Small Business Has Its Place in War Production

A great deal has been said about the large corporations obtaining almost all of the war production contracts. It is true that most of the large prime contracts have been given to large concerns for the reason that no small concern would be capable of handling business of such large proportions. On the other hand, the small concern, whenever capable of handling the work, usually gets its share of the contract. General Motors, for example, has not less than 18,735 sub-contractors and suppliers who are working with General Motors in the production of war materials. The Western Electric Co., in filling its war contracts, has employed more than 6500 sub-contractors and suppliers.

* * *

The four freedoms that have made America great in the past are Freedom of Speech, Freedom of Worship, Freedom to Work, and Freedom of Enterprise. The Freedom from Fear and the Freedom from Want that have more recently been incorporated in a definition of the four freedoms are, as far as it is humanly possible to achieve them, direct correlates of the other four freedoms. The two latter freedoms cannot be assured by any government, but the other four can and should be so assured. They represent all that America stands for.

When the great task is undertaken to rebuild the world to a new industrial pattern, LAKE ERIE Hydraulic Presses will set a fast pace for production schedules.

New Books and Publications

MANUAL FOR ON-THE-JOB INSTRUCTION OF SCREW MACHINE PERSONNEL. 107 pages, 7 by 9 inches. Published by the National Screw Machine Products Association, 13210 Shaker Square, Cleveland 20, Ohio. Price, $2.

This book provides instruction material for training screw machine operators, based on an intensive study made by the National Screw Machine Products Association of the manpower shortage and existent methods of training. It was found that with present methods Class A screw machine operators could not be trained in less than two years, or set-up men in less than four years. The purpose was to find a satisfactory and more rapid method of training. The material covers all types of multiple-spindle automatics, and gives step-by-step procedures for setting up and operating. Extensive data on grinding and setting tools, as well as comprehensive trouble charts, are included.

DESIGN OF MACHINE MEMBERS. By Alex. Vallance and Venton L. Doughtie. 559 pages, 5 1/2 by 8 1/2 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $4.

This is the second edition of a book on the design of machine members prepared for the use of students who have had some training in kinematics, mechanics, and factory processes. The book explains the theory involved in the design of the elements of operating machines, and points out the variations from theory required by practical applications. In the new edition, the text has been revised to cover new developments in materials and design procedure, and additional information is included on non-ferrous materials, as well as non-metallic materials, such as plastics, synthetics, and the so-called rubber substitutes.

KINEMATICS AND MACHINE DESIGN. By Louis J. Bradford and George L. Guillet. 357 pages, 5 1/4 by 8 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $3.

Recent developments in technical instruction have brought forth courses in machine design that are shorter and more condensed than those formerly offered. Students in these courses need to know the language of machine design and the standard methods of designing the ordinary machine elements, as well as to be grounded in the more essential parts of kinematics. In order to furnish a text suited to short combined courses of this character, this book has been prepared by consolidating the texts of two books previously used in giving fundamental training to college students in mechanical, electrical, and industrial engineering.

LUBRICANTS AND CUTTING OILS FOR MACHINE TOOLS. By William G. Forbes. 87 pages, 5 1/2 by 8 1/2 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $1.50.

The purpose of this book is to explain the fundamental principles of lubrication in relation to metal-cutting and the application of various types of cutting oils to machine tool operations. In addition, the principles of machine tool lubrication are discussed from the viewpoint of practical maintenance. The book contains nine chapters as follows: Tests and Specifications; Greases; Types of Machine Tools; Lubrication of Machine Tools; Metal-Cutting; Composition of Cutting Oils; Compounds and Blends of Cutting Oils; Application of Cutting Oils; and Skin Infections.

DIESEL LOCOMOTIVES. By John Draney. 472 pages, 5 1/2 by 8 1/2 inches. Published by the American Technical Society, Drexel Ave. at 58th St., Chicago, Ill. Price, $4.

This book covers the Diesel engine with particular reference to its use in railway transportation. The work is the product of the collaboration of a number of eminent engineers associated with railroads and Diesel locomotive manufacturing concerns. It discusses the characteristics of engine cycles and combustion principles in modern Diesel engines; describes in detail the various types of Diesel engines and the mechanical features of the Diesel locomotive; and gives complete operation and maintenance instructions.

PLANING, SHAPING, AND SLOTTING. By Fred H. Colvin. 125 pages, 5 by 8 inches, 120 illustrations. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $1.25.

This is a brief introduction to the work performed on planing, shaping, and slotting machines. The general construction of these machines is described, and information is given on cutting tools, methods of clamping and holding work, setting up work on planers, etc. Examples of work performed on these machines are shown.

LIGHTING HANDBOOK. 175 pages. Published by the Lamp Division of the Westinghouse Electric & Mfg. Co., Bloomfield, N. J. Price, $1.

STEEL PRODUCTS MANUAL. 215 pages, 6 by 9 inches. Published by the American Iron and Steel Institute, 350 Fifth Ave., New York City. Price, $2.50.

This manual contains instructions approved by the Army Service Forces, the Navy Department, and the U. S. Treasury (Procurement Division) for wrapping, tying, boxing, marking, and loading various steel products for overseas shipment.

MAINTENANCE ARC WELDING. 234 pages, 6 by 9 inches; 242 illustrations. Published by the James F. Lincoln Arc Welding Foundation, Cleveland, Ohio. Price, 50 cents in the United States; 75 cents elsewhere.

HOW TO TRAIN WORKERS QUICKLY (Manual for Training Men and Women in Wartime). By Glenn Gardiner. Published by the Elliott Service Co., 219 E. 44th St., New York 17, N. Y. Price, 45 cents.

SYMPOSIUM ON POWDER METALLURGY. 60 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa. Price, $1.

Coming Events

JANUARY 10-14—Annual meeting and engineering display of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

MARCH 26-28—Annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS to be held at Philadelphia, Pa. Adrian L. Potter, executive secretary, 2567 W. Grand Blvd., Detroit 8, Mich.

APRIL 25-28—THIRD WAR PRODUCTION FOUNDRY CONGRESS AND FOUNDRY SHOW of the American Foundrymen's Association, to be held at the Memorial Auditorium, Buffalo, N. Y., in conjunction with the forty-eighth annual meeting of the Association. Executive office, American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

OCTOBER 12-14—Semi-annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS at Syracuse, N. Y. Adrian L. Potter, executive secretary, 2567 W. Grand Blvd., Detroit 8, Mich.

OCTOBER 16-20—Twenty-sixth annual meeting of the AMERICAN SOCIETY FOR METALS AND THE NATIONAL METAL CONGRESS, to be held at the Public Auditorium, Cleveland, Ohio.

LAST MONTH HE WAS SANTA IN THE TOY STORE

THIS MONTH HE TOOK HIS

GRANDSON'S PLACE

AND HE'S DRIVING SCREWS LIKE A 21-YEAR OLD.

FOR THE PLANT WHERE HE WORKS USES THE RECESSED HEAD

SCREW THAT MAKES DRIVING DUCK SOUP...

IT'S PHILLIPS ➡➡➡➡

THE ENGINEERED RECESS

Anyone can drive Phillips Screws! Today, screw driving is one production job anyone can tackle without any special talent or training. The job that once called for strong arms and skilled hands now is a cinch for the operator who never tackled a screw driving job before!

It's the Phillips Recessed Head Screw that does the trick! With Phillips Screws, the greenest operator quickly becomes as skillful as a veteran. No fumbling . . . no wobbly starts . . . no slant-driven screws or dangerous screw driver skids. Workers turn out flawless jobs every time — and faster than ever before. Time studies prove that Phillips Recessed Head Screws step up screw driving speed as much as 50 per cent!

Imagine what this means to you in terms of man-and-training-hours saved . . . of increased production . . . finer workmanship. Then match these important advantages against slotted head screws — or any other type you may be using.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS · MACHINE SCREWS · SELF-TAPPING SCREWS · STOVE BOLTS

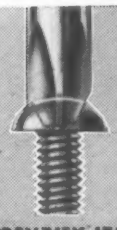
TO MAKE WARTIME QUOTAS AND PEACETIME PROFITS

Faster Starting: Driver point automatically centers in the Phillips Recess . . . fits snugly. Fumbling, wobbly starts, slant driving are eliminated. Work is made trouble-proof for green hands.

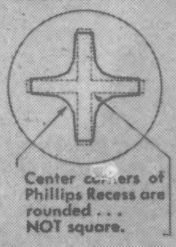
Faster Driving: Spiral and power driving are made practical. Driver won't slip from recess to spoil material or injure worker. (Average time saving is 50%.)

Easier Driving: Turning power is fully utilized. Workers maintain speed without tiring.

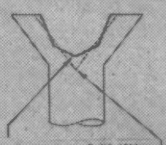
Better Fastening: Screws are set-up uniformly tight, without burring or breaking of screw heads. The job is stronger, and the ornamental recess adds to appearance.



IDENTIFY IT!



Center corners of Phillips Recess are rounded . . . NOT square.



Bottom of Phillips Recess is nearly flat . . . NOT tapered to a sharp point.

23 SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

Classified Contents of This Number

Your Progress Depends Upon Your Knowledge of Your Industry